Master's Thesis

Which Factors Drive Mergers & Acquisitions?

Empirical evidence from the U.S. software industry

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Abstract

This thesis examines whether micro- and macroeconomic factors explain mergers and acquisitions (M&A) within the U.S. software industry in the period of 1994 to 2019. The software industry is relatively lesser studied than long-established industries within the M&A literature such as industrials and banking. Therefore, it is highly relevant to study whether the software industry is affected by the same firm-specific and macroeconomic factors as long-established industries are. Furthermore, this thesis examines the 5th, 6th and 7th M&A waves by using the theoretical framework of eight theories concerning the micro- and macroeconomic factors. These eight theories build upon behavioral and neoclassic economic theories and encompass respectively (1) managerial hubris, (2) herding, (3) agency, (4) misvaluation, (5) efficiency, (6) market power, (7) industry shock and (8) economic prosperity.

This thesis employs deal volume as a proxy for M&A activity based on 92 quarterly observations. The methodology applied to examine M&A activity follows previous literature, and the multiple regression analysis is the statistical method commonly used among researchers. As previous literature suggests, the inclusion of micro- and macroeconomic factors is vital to examine the determinants of M&A holistically. The multiple regression model was applied to analyse the underlying drivers of M&A within the U.S. software industry. This thesis performed two regression models: a model on significant micro- and macroeconomic factors and a model containing microeconomic variables exclusively. A model for macroeconomic factors was also performed, but it was identical to the model containing significant micro- and macroeconomic variables and was therefore removed. The empirical findings derived from the regression models indicate support for the hubris, herding, efficiency, and partly economic prosperity theories. Hence, the findings did not support the agency, misvaluation, industry shock and marker power theories as significant for M&A activity within the U.S. software industry. Comprehensively, behavioral and neoclassic factors proved to be effective prognosticators of M&A activity. Consequently, the empirical findings of this thesis support the existing literature suggestions of including both micro- and macroeconomic factors to accurately explain the underlying mechanisms impacting M&A activity.

This empirical investigation of M&A activity discovers that both micro- and macroeconomic factors are significant in explaining M&A activity within the U.S. software industry. Furthermore, evidence derived from the regression models indicate that variables from behavioral and neoclassic economics paradigms were significant to explain the observed M&A behaviour.

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Chapter 1

1.1 Introduction

Mergers and acquisitions have been a widely adopted tool for strategic acquirers and private equity firms since its inception in the early 1990's. M&A transactions within the software industry have globally surged remarkably with a CAGR of 17.7% from 2013 to 2021, deal volume grew from 1.681 to 6.201 in the period. The United States recorded the most M&A transactions within the technology segment from 2013-2019 and accounted for more than 50% of deals completed in every fiscal year in the corresponding period, marking its dominance as the global technology hub (Drazdou, 2023). The second largest M&A market in the technology industry is Europe where United Kingdom, Germany and France performed remarkably well with a collective market share of 53.6% of completed deals in Europe. In 2019, transactions completed reached 5.166 and domestic acquirers accounted for 68% and cross-borders transactions accounted for 32% (Drazdou, 2023). When considering which scope to examine for this thesis. the U.S. technology industry has been selected for serval factors: the largest technology firms are in the U.S, Silicon Valley being the global hub for innovation and the U.S. being the dominant force within M&A transactions.

Numerous of studies also found that M&A activity have a nonlinearly pattern, meaning the activity clusters in certain periods and in specific industries. These waves can be observed as a response to external shocks within certain industries. Empirical studies found that M&A activity originate as a response to deregulation, technological advancements, industry growth and changes in demand and supply conditions, which have encouraged managers to respond externally through M&A to adjust to the new business environment (Michell et all, 1996). Furthermore, the exponential demand for technology firms have accelerated for serval reasons. Software firms can scale products rapidly through digitalization and the SaaS business model providing predictable and stable cashflows. Furthermore, the industry has relatively low capital expenditures compared to industrial industries, therefore providing high gross margins and adequate return on invested capital. Lastly, the potential for disrupting existing industries enabling acquirers' exponential growth opportunities (Drazdou, 2023).

The neoclassic rationale for engaging in M&A activity is when the expected cash flow exceeds the price paid. However, 80% of completed M&A deals erode shareholder value, indicating that other factors such as the behavioral aspect of managers highly impact M&A activity (Bruner, 2004). Prior literature from respected scholars within the fields of finance and economics indicate that M&A activity is more complicated than the neoclassic Net Present Value (NPV) approach. behavioral factors such as herding and managerial hubris negatively affect the rationality of managers, which evidently leads to devastated shareholders (Bruner, 2004). Furthermore, academic literature provides two explanatory components for M&A activity; neoclassic and

behavioral economics theory, which incorporate microeconomic and macroeconomic variables. Hence, this thesis incorporates both elements to accurately examine the determinants of M&A activity.

The underlying objective of this thesis is to examine the micro- and macroeconomic drivers of M&A activity in the U.S software industry for the 5th, 6th and 7th wave. In contribution to academia, the 6th and 7th M&A wave will be incorporated in this paper, which is studied to a lesser extent than former M&A waves. Furthermore, this paper will apply deal volume as proxy for M&A activity, which is in line with prior empirical studies. Deal volume is reflecting the breadth of the wave, as is treat all transactions equally (Bruner, 2004).

1.2 Research Question

The objective for this thesis is to examine whether micro- and macroeconomic factors influence M&A activity in the U.S. software industry. This examination will include neoclassic and behavioral economics theories to provide clarification of which factors have the most influence towards M&A activity in the U.S. software industry. The research question is the following:

Can microeconomic and macroeconomic factors explain the overall M&A activity within the U.S. software industry?

1.3 Delimitations

1. The period of investigation is limited to encompassing three M&A waves: The dot.com bubble (1992-200), the wave leading up to the financial crisis (2003-2007) and the latest M&A wave (2011-2019). The former M&A wave is the least studied, therefore it is highly interesting to incorporate the latest M&A wave in this thesis.

2. This thesis has chosen to limit the scope to targets being classified as a U.S. software company. Furthermore, the acquirer is also from the U.S. and operates across a variety of industries within the U.S. Furthermore, due to data availability only public acquirers and targets are considered in this thesis. Additionally, when the geographical scope is limited towards focusing only on M&A transactions within the U.S. The need to adjust for macroeconomic variables is eliminated. However, the data from the public targets were limited, therefore the company specific data incorporated in this thesis are from the acquirers exclusively.

3. The deal types which are incorporated in this thesis are restricted towards the following deal types: mergers and acquisitions. This implies that deals such as leveraged buy-out, spinoffs, exchange offers, privatizations, buy-out, and minority stakes are excluded in this research paper. Furthermore, the M&A transactions must be completed for the deal to be included in this project.

4. The scope of this thesis will incorporate variables from the eight theories containing micro- and macroeconomic variables. The chosen research approach is deductive, and each theory encompass a variable which will be examined through the regression model. This research approach is consistent with previous literature studying the U.S. M&A industry.

5. The theoretical drivers for engaging in M&A activity is examined from the perspective of the acquirer, which is the common approach among scholars.

1.4 Methodological Practice

This section presents the methodological approach of this thesis, and the strategy utilized to analyse the determinants of M&A activity. The methodological choices are highly intercorrelated with the nature of the data and how we approach the research question of this thesis.

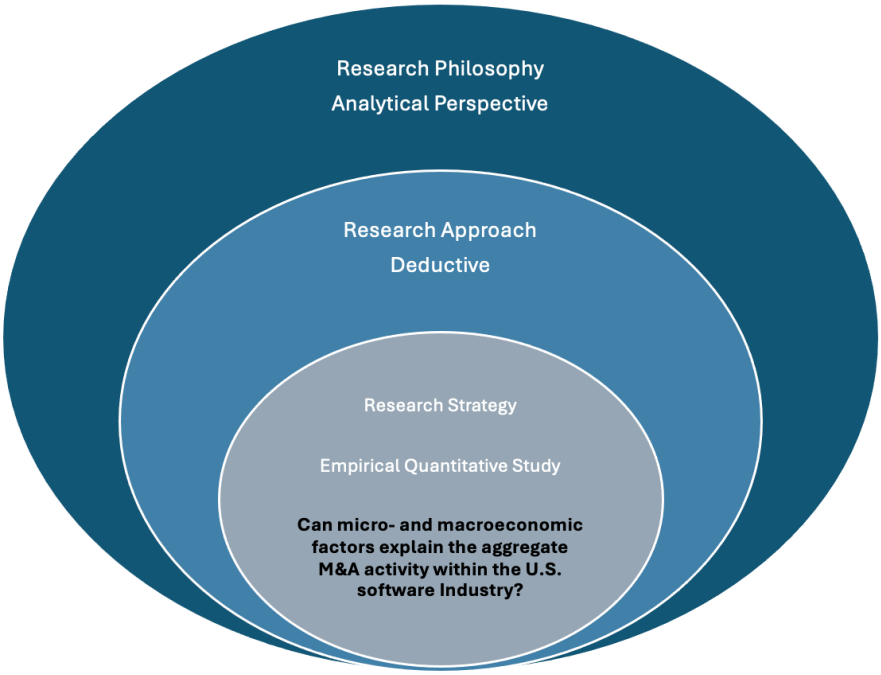
1.4.1 Research Strategy

The research strategy must be selected meticulously to connect the research question with the appropriate method. For this thesis, the analytical perspective was selected due to the data being of quantitative nature. In the analytical perspective, facts are perceived as objective or subjective and both can be true. However, being concerned with data validity, this methodological approach favours logic and mathematics to ensure that objectivity is maintained from the findings derived from these econometric models (Arbnor & Bjerke, 2009). This research strategy provides objective and measurable conclusions, which enhances the practicability for researchers and practitioners. The selected econometric model for this thesis is multiple regression using panel data. The rationale for employing panel data is because of its ability measure multiple variables for assets across different time periods.

The rationale for choosing a quantitative research strategy stems from the nature of the data, which are a combination of microeconomic and macroeconomic quantitative variables. The purpose of this thesis is to generate measurable conclusions; therefore, an empirical model will be applied to analyse the determinates of

M&A activity. The source of the microeconomic data for this project stems from FactSet, which ensures high quality and validity of the data. An adequate sample size is vital for ensuring high validity and robustness of the results obtained from this thesis. Furthermore, the analytical methodology is the widely preferred method for studying determinants of M&A activity.

Figure 1: Research Strategy



Source: Own Creation

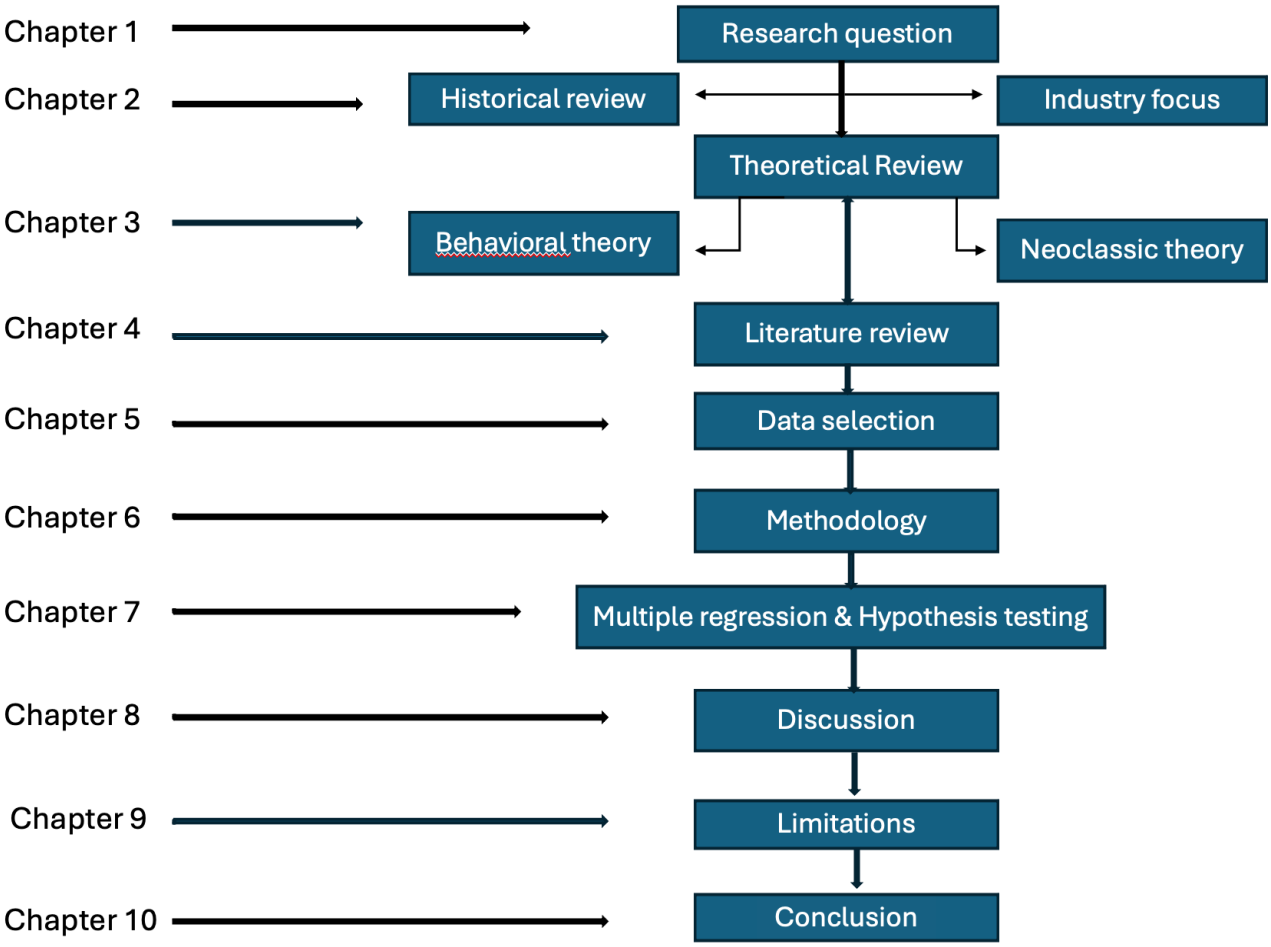
1.4.2 Research Approach

The research approach for this thesis is conducted according to the analytical view. In the analytical view, the researcher's objective is to stay independent from the data gathering (Arbnor & Bjerke, 2009). The aim of this thesis is to examine the internal and external environment's impact towards M&A activity with objective and measurable data to ensure a valid examination of the research question. The theory in this thesis incorporates micro- and macroeconomic variables influence towards M&A activity, enabling a quantitative and objective examination of the research question. Lastly, the aim of this thesis is to determinate the drivers behind M&A activity through the theoretical framework presented in section 3.1 and 4.1.

To examine the research question of this thesis, the deductive approach will be employed to accurately answer the research question. The deductive approach is concerned with hypothesis testing and based on the existing theoretical framework developed by previous scholars. The deductive approach is the widely preferred approach by researchers when the data is quantitative, measurable and the sample is unbiased and of adequate

size. Hence, the theoretical framework developed by previous scholars within M&A was gathered to develop the research design for testing the research question for this thesis. The aim is to draw conclusions regarding the research question and examine which factors are of the highest significance in relation to M&A within my scale and scope.

Figure 2: Thesis Structure



Source: Own Creation

Figure 2 presents a visual overview of how the thesis is structured.

Chapter 2

This chapter presents the neoclassic rationale for corporate managers to pursue M&A deals. Furthermore, an examination of the historical M&A waves and the underlying factors influencing the activity holistically.

2.1 Introduction to M&A

In general terms, mergers and acquisitions refers to the consolidation of companies or corporate assets through various types of financial transactions. Merges occur when two corporations form a new legal entity and move forward as a single entity. In contrast, Acquisition is a takeover where a corporation purchase a majority stake or the whole entity (Bruner, 2004). In this paper, M&A will refer to both types of strategic actions.

Primarily, three types of M&A strategies prevail: vertical, horizontal, and conglomerate. Vertical M&A occurs when firms in different production stages strategically combine forces. The objective of vertical M&A activities is to secure essential inputs to production and thereby exercise supply constraints to competitors (Bruner, 2004). In contrast, horizontal M&A involves two corporations that offer similar products and operate at the same industry level. The main objective of horizontal mergers is to reduce industry concentration and increase the combined market share of the new entity. Furthermore, horizontal M&A enables corporations to gain competitive advantages such as achieving economics of scale and scope (Bruner, 2004). Finally, conglomerate M&A activity are where corporations acquire unrelated business for diversification purposes and from behavioral perspective to expand the managerial empire.

2.1.1 Neoclassic M&A Rationale

Companies acquire or merge with other companies for securing long-term growth opportunities, gaining competitive advantages, influencing supply chain, prompt market entry and increase market share (Bruner, 2004). Furthermore, companies also engage in M&A as a response to industry shocks and changing macroeconomic conditions (Gort, 1969).

The neoclassic rationale for pursuing M&A deals lies in the value creation obtained from realizing synergies, that a combined entity is worth more than two separate entities 2+2=5. However, only 20 percent of all mergers succeed, most mergers erode shareholder value (Bruner, 2004). Furthermore, as expressed by Mark Sirower Vice President of Boston Consulting group:

"*The easiest way to lose the acquisition game is by failing to define synergy in terms of real, measurable improvements in competitive advantage*" (Bruner, 2004. P. 325).

The discounted cash flow valuation is highest rated method in terms of valuing the free cash flow (FCF) expected to be obtained from realizing the synergies. It is crucial to estimate the expected cash flows as it enables the manager to undertake an informed rational decision regarding the investment (Bruner, 2004). The formula is presented below and FCF is discounted at the weighted average cost of capital (WACC) to determine the present value of the cash flow.

$$V_{Synergies} = \sum_{t=0}^{n} \frac{FCF_t}{(1 + WACC)^t}$$

The formula for WACC is presented below and E is the amount of equity, r_e is the cost of equity, D is the amount of debt, r_d is the cost of debt and finally t_c is the corporate tax rate.

$$WACC = \frac{E}{D + E} r_e + \frac{D}{D + e} r_d * (1 - t_c)$$

The motive for managers to pursue M&A increases when the value of the expected synergies rise. The DCF formula implies that synergies can be obtained from improvements in FCF, WACC or in both factors. FCF and WACC are impacted by micro- and macroeconomic factors, especially interest rates have a substantial impact on investment decisions and access to capital markets to finance the M&A transactions (Bruner, 2004). Multiple synergies can arise from M&A: revenue enhancement, cost reduction, asset reduction, managerial and financial synergies obtained from a lower WACC of the combined firm. Furthermore, valuing the synergies is a critical foundation for a successful postmerger integration (Bruner, 2004). In corporate finance, one of most acknowledged methods applied in evaluating investments decisions is the net present value (NPV) approach. The general rule is, if the NPV of the project is greater than zero the managers should undertake the investment and if projects are mutually exclusive, we select the project with the highest NPV (Gonzalez et al, 1997). The mathematical formula for NPV is presented below:

$$Net\ Present\ Vale\ (NPV) = \sum_{t=0}^{n} \frac{CF_t}{(1 + r)^t} - initial\ investment$$

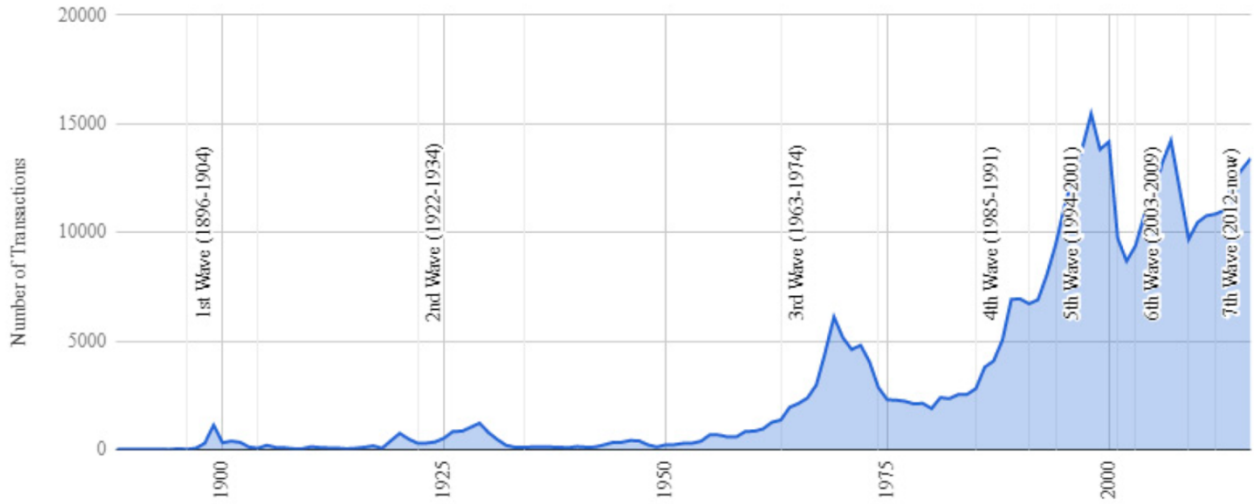
In the formula CF is the projected cash flow at time t, and r is the cost of capital at time t. The NPV approach is also highly influenced by micro- and macroeconomic factors which influence the projected cash flow and cost of capital. The microeconomic environment determinates the value creation within an industry and thereby the rationale for corporate managers to engage in M&A activity. The macroeconomic environment is also highly relevant, influencing the attractiveness of M&A. Furthermore, WACC is composed of cost of equity and debt, when cost of capital increases it reduces the NPV of projects (Gonzalez et al, 1997). However, 80%

of M&A transactions erode shareholder value, meaning managers overestimate synergies and NPV of projects. Academic literature has found evidence of superior economic performance from M&A in related industries due to synergies and economies of scale and scope, companies in unrelated industries as conglomerate M&A activity generally erode shareholder value (Bruner, 2004). In other words, horizontal and vertical M&A are statistically more successful than conglomerate-related M&A. To succeed in M&A, it is highly contingent upon both an organizational and strategic fit to extravagate the synergetic gains from the collaboration. Therefore, it clarifies the importance of including both micro- and macroeconomic factors when examining the drives of M&A activity.

2.2 Historical Review of M&A Waves

This section provides a historical review of M&A waves over the past century. Furthermore, as illustrated in figure 3, it is evident that M&As occur in waves of high activity followed by periods of relatively low activity. M&A waves have historically occurred when interest rates are depressed and in periods of high economic growth (Bruner, 2004). Furthermore, from a microeconomic perspective these waves occur in specific industries where technological innovation, deregulation and strong demand are present (Gort, 1969).

Figure 3: Historical M&A waves



Source: MDPI (2004)

The first merger wave emerged from 1895 to 1904 in the United States and was characterized by excessive horizontal merger activity, in academia this period is referred to as “merging for monopoly” (Bruner, 2004). Industrial giants such as Dupont, Standard Oil, American Tobacco, General Electric and Eastman Kodak were originated during this period. The merger activity was accompanied by a period of economic expansion and

technological advancement after the depression that ended in 1896. Technological innovations created overcapacity for firms and as a response they sought to build market power through M&A (Bruner, 2024). However, the implementation of antitrust laws which prohibited large enterprises in engaging in horizontal merger activity, a weak banking system and the stock market crash of 1904 ended the first M&A wave (Bruner, 2024).

The second merger wave occurred from 1925 to 1929 in the U.S. and this period is referred to as "merging for oligopoly". This wave was characterized by intensive vertical mergers which increased industry concentration, firms sought to integrate backward into supply and forward into distribution (Bruner, 2004). The business activity in this period was characterized as conglomerate activity and firms benefited from economies of scale and widespread price-fixing occurred across industries which threaten even competition. In this period, the economy experienced an economic boom with favourable access to the capital market, strong underlying economy and technological advancements. The wave ended with the Great Depression in 1929 and the passage of the Clayton Antitrust act which brought this era to an end (Vazirani, 2015).

In 1956, the third M&A wave emerged from a booming stock market and high economic prosperity in the overall economy in the United States. In this period, firms pursued conglomerate M&A strategies and acquired companies in unrelated industries to increase growth and correspondingly reduce earnings volatility. The activity of this wave was predominantly concentrated among a group of conglomerates and oil firms (Bruner, 2004). Companies with high P/E ratios diversified into unrelated industries by acquiring business with lower P/E ratios. As a result, companies expanded their EPS through acquisitions rather than through reinvestments (Vazirani, 2015). The conglomerate area was highly financed through debt and equity, companies applied the P/E ratio rationale to justify their expansionist activities. Eventually, as it became increasingly difficult for serial acquirers to find targets with low P/E ratios combined with the stock market crash in 1969 and antitrust enforcement against conglomerate activity the wave came to an end (Bruner, 2004).

The fourth M&A wave emerged in 1981 and involved leveraged buyout (LBO), corporate raiders, divestitures, going private transactions and a unique characteristic of this specific wave was a high level of hostile takeovers relative to former M&A waves (Bruner, 2004). However, M&A activity was broad based influencing virtually all sectors in the United States and dominated by small- and medium sized firms. Innovation and technological advancements disrupted existing industries and new ones emerged during this period. Investment bankers were in aggressive pursuit of M&A deals, and they developed innovative products designed to facilitate or prevent takeovers. Furthermore, corporate raiders employed the junk bond market to finance their highly leveraged deals, which was a unique distinctiveness of the fourth wave. The Tax Reform Act of 1986 contributed significantly to M&A activity combined with rising stock market and decreasing interest rates (Bruner, 2004).

The wave ended in 1989 due to economic slowdown, takeover defence mechanisms and the collapse of the junk bond marked which was the primary source for financing the LBOs (slide 24).

Following the 1990 to 1991 recession, M&A activity rebounded sharply in 1992, fewer hostile takeovers and a high level of strategic mergers occurred in the United States in 1992 and Europe from 1998 (Vazirani, 2015). The strategic mergers occurred as firms sought to expand into new markets and pursue synergies (Bruner, 2004). Globalization, technological advancement, favourable economic environment consisting of rising stock prices and low interest rates initiated the fifth M&A wave. Furthermore, the fifth wave was a worldwide phenomenon, outside of the United States, the M&A wave occurred primarily in Europe and Asia (Bruner, 2004). The dot.com wave was initially triggered by microeconomic factors such as innovation and advancement in the information technology and software (Bruner, 2004). Major M&A deals concentrated in all industries such as banking, finance, healthcare, defence communications, and technology. As the wave progressed firms employed inflated equity valuations as the primary method to for financing the M&A transactions. Empirical studies reveal that acquiring firms' shareholders lost 240 billion USD from acquisitions between 1998 and 2001 (Bruner, 2004). Furthermore, empirical findings suggest that acquisitions in the beginning of the wave enhanced shareholder value (Moeller et al, 2005). Following the burst of the Internet bubble in March 2000, M&A activity declined sharply in tandem with the U.S. economy and stock market and ended the fifth M&A wave (Bruner, 2004).

By 2004, M&A activity began to increase significantly after the economic shock from 9/11 as a response, the Federal Reserve lowered interest rates. This led to a speculative international real estate bubble originated from mortgage-backed securities in the U.S. The macroeconomic landscape consisted of high economic activity, low interest rates and a rising stock market (Bruner, 2004). Private equity firms thrived in this era as they raised capital through equity and debt at extremely attractive rates to buy companies with the purpose of selling at inflated valuations. However, the wave came to an end in 2007 following the subprime crisis and financial crisis (Bruner, 2004).

In 2011, the economy rebounded after the financial crisis, which triggered the sixth M&A wave. Firms' incentive to pursue M&A deals increased as the economic landscape contained high GDP growth and low interest rates (Kengelbach et all, 2017). The M&A activity in the period was of international nature with a strategic focus towards emerging markets, and firms sought to reinvent and digitalize their business model to accommodate the rapid innovation in their corresponding industries (Kengelbach et all, 2017). An empirical study conducted, concludes that the total shareholder return of weak-economy merger deals was almost 9% greater than mergers in a strong-economy and generated positive returns on average (Kengelbach et all, 2017). The sixth wave ended in 2019 due to COVID-19.

As summarized in Table 1, the historical review of the last seven merger waves have occurred with a macroeconomic environment consisting of high economic growth, rising stock prices and low interest rates. The behaviour of the M&A waves has historically been of cyclical nature, the activity has increased substantially when economic growth and low cost of capital is present in the economic landscape, and the waves tend to end with an overall economic slowdown. However, the M&A activity concentrate in specific industries, suggesting that microeconomic factors influence which industry the M&A activity appears in. Furthermore, when studying the historical waves companies reacting to shocks in their operating environment such as deregulation, emergence of new technology, distribution channels and digitalization through M&A. It is evident that M&A waves are a macro- and microeconomic phenomenon, therefore highly relevant to study both when examining the underlying drivers behind M&A activity.

Table 1: Summary of Historical M&A waves and Drivers

	1st wave	2nd Wave	3rd Wave	4th Wave	5th Wave	6st Wave	7th Wave
Period	1895 - 1904	1925 - 1929	1956 - 1970	1981 - 1987	1992 - 2000	2003 - 2007	2011 - 2019
Primary source of	Cash and debt	Equity	Equity	Cash	Equity	Debt and Equity	Cash and debt
Type of M&A	Monopolies (horizontal)	Oligopolies (Vertical)	Conglomerate Era	Corporate raiders, LBO, hostile takeovers	strategic buyers persuing Internalization, synergies and digitalization	Internalization	Internalization
Geography	U.S.	U.S.	U.S.	Central Europe, UK and U.S.	International	International	International
Industry Focus	Manufacturing and industrials. Strategic focus towards creating monopolies	Merging across industries to establish economics of scale and gain mass distribution	Acquisitions in unrelated industries with the objective of diversify their business operations	Broad-based M&A activity in virtually all sectors and firm size. Strategic focus on technology and specialization	Strategic focus towards achieving economies of scale and expanding to new markets through M&A in tech, finance, healthcare and communication	Stratetic focus towards internalization	Strategic focus towards emerging markets and digitalization of business models
Macroeconomic characteristics	Technology advancement and adoption of commercial electricity. High economic growth and low interest rates	Advancements in manufacturing, communication and technology. Strong economy and access to capital markets	Longest bull market ever recorded and a strong underlying economy.	Investment bankers designed innovative financial products to engage in M&A activity. Deregulations, favorable economy with rising stock market and low	Globalization and disruptive technologies emerged in this era. High GDP growth, rising stock prices, low interest rates and hubris	Strong economy with economic growth, rising real-estate and stock prices and low interest rates	Strong economy with GDP growth, low interest rates
End of wave	Weak banking system, antitrust laws and stock maret crash of 1904	Antimonopoly trust laws and the Great Depression	Antitrust enforcement against the rise of conglomerates ended the wave	Antitakeover laws and stock market crash	Burst of dot.com bubble followed by a brief recession	Subprime crisis and the Financial crisis in 2008	Covid-19

Source: Own creation

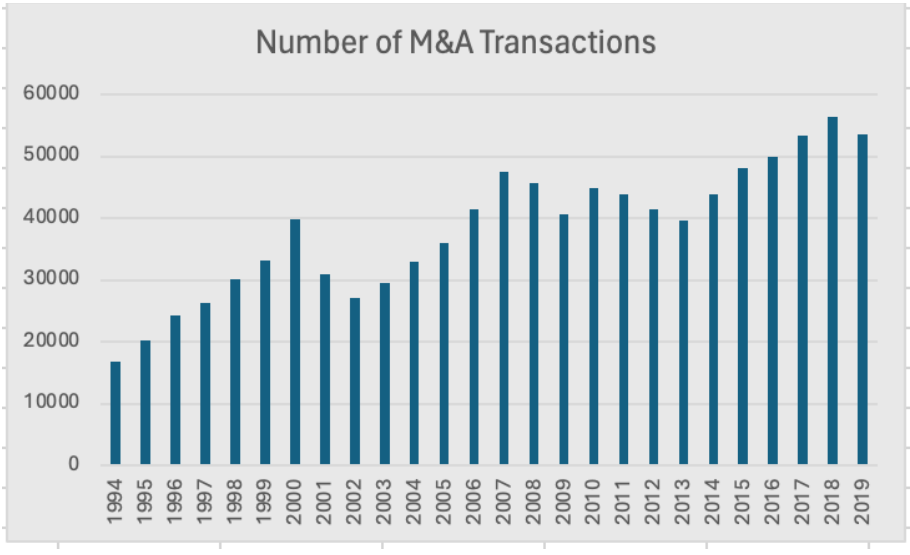
2.3 Geography and Industry Focus

The purpose of this section is to clarify the rationale behind the scope of this thesis being the U.S. software industry.

2.3.1 Recap of the former M&A waves

The software industry has been a segment with limited study in academia relative to long-established industries. In the first three M&A waves the geographical focus was limited towards U.S. industries such as manufacturing, industrials and banking, they pursued vertical, horizontal and conglomerate strategies to gain market power (Bruner, 2004). The fourth M&A wave included UK, Central Europe and the United States, the wave was broad-based and included virtually all sectors within the United States. Furthermore, Investment bankers were in aggressive pursuit of M&A deals and the term corporate raider became a well-known term during the fourth wave (Bruner, 2004). Furthermore, Innovation and advancement in technology disrupted existing industries and new ones emerged during the fourth wave. The three latest M&A waves were global and virtually all industries were impacted. Globalization played a significant part, and companies were encouraged to expand internationally to reach foreign markets following deregulation. An important contributor for these periods were technological innovation and firms sought to digitalize their business model to capture the new business environment (Bruner, 2004).

Figure 4: Global M&A Transactions



Source: Own creation, data collected from Statista

When examining the previous M&A waves they all had common macroeconomic denominators such as a strong underlying economy. The macroeconomic landscape in the three previous M&A waves were

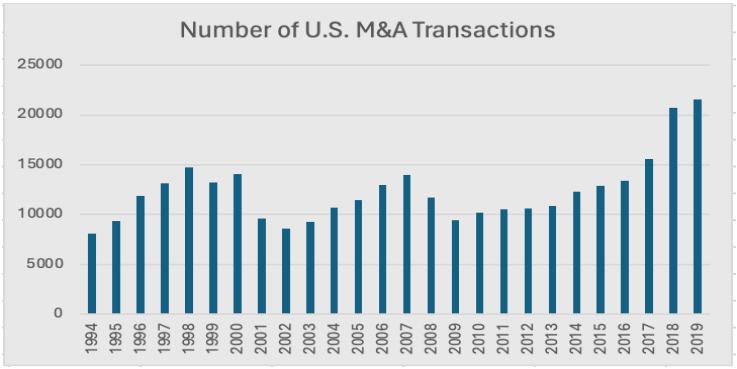
characterized by high economic growth, rising stock market and low cost of capital. However, the first M&A waves (1992-200) was initiated by innovation in the technology segment more specific in information technology and software which triggered the dot.com wave, suggesting a microeconomic driver. The second wave leading up to the financial crisis (2004-2007) was triggered by a favourable macroeconomic environment where the U.S. lowered the interest rate following 9/11. The third wave (2011-2019) was triggered by an economic upswing following the financial crisis with a favourable macroeconomic landscape consisted of low interest rates and high economic growth. Hence, to study the former three waves this thesis will incorporate microeconomic and microeconomic variables to fully examine the factors influencing M&A activity. As illustrated in figure 4, the demand for global M&A deals has been on an upward trajectory since 1994 with yearly periods of pullbacks, suggesting deal volume is non-stationary.

2.3.2 The U.S. Software Industry

The purpose of this section is to clarify the rationale for selecting the U.S. software industry as the study area for this thesis. To examine the micro- and macroeconomic factors impact towards M&A activity, the geographical range must encompass an area with rich extensive historical data with high validity.

The United States accounts for the highest market share regarding M&A transactions with a market share between 30-50% from 1985 to 2018. Since 1985, more than 325.500 M&A transactions have occurred with a transaction volume of 34.900 billion USD. The number of transactions has expanded with a CAGR of 5.86% in the 33-year period. As evident in figure 5, M&A transactions have surged substantially from 1994-2019 with regular yearly pullbacks.

Figure 5: M&A transaction in the United States

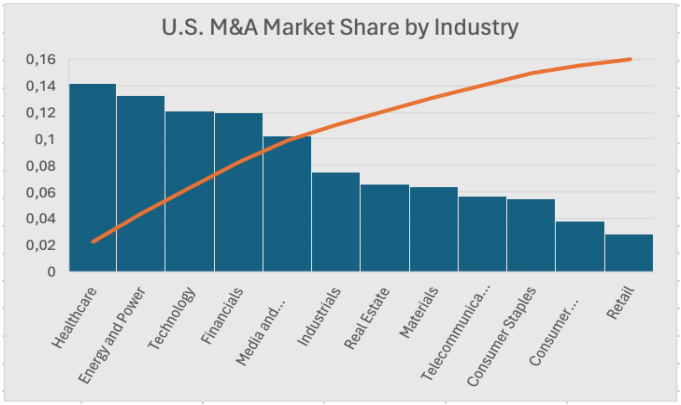


Source: Own Creation and data collected from IMMA (2024)

The industry with the highest concentration of M&A deals is the technology segment, which accounts for 19.9% of transactions completed in the period from 2000 - 2018 (IMMA, 2024). Therefore, the U.S. provides

an extensive wealth of historical data for the software industry which ensures high quality and validity of data. A large contributor to the U.S. tech industry is the well-known technological hub of the world, Silicon Valley located in California. Silicon Valley is housing the largest technology companies such as Appel, Alphabet, Facebook, AMD and Intel. Corporate America has a significant presentence in Silicon Valley due to the business ecosystem well-known for innovation and obtaining and preserving the competitive edge (Berger et al, 2016). Unicorns from the bay area include Airbnb, Uber and Netflix, which successfully have disrupted long-established industries. The innovative business model of Airbnb which offers 1.2 million listings in 190 countries without owning real estate and with an employee force of 800. Silicon Valley has the world's densest concentration of technology companies and attracts a world-class pool of international talent with strong beliefs that nothing is impossible. Furthermore, Silicon Valley is well-known for providing early-stage funding to entrepreneurs which is vital for the versatile business environment (Berger et al, 2016). Certainly, these arguments clearly illustrate the practical importance of studying the U.S. software industry. In figure 6, the technology industry is the third largest M&A segment in the U.S accounting for a 12% market share in 2019.

Figure 6: M&A Market Share by U.S. Industries for 2022



Source: Own Creation and data collected from IMMA (2024)

2.3.3 Definition and Characteristics of the U.S. Software Industry

The software industry is divided into the following segments: *application software*, *enterprise software, Software-as-as- service (SaaS), cybersecurity, database and analytics software, digital transformation and artificial intelligence software (AI)*. A major trend in the recent decade has been the integration of cloud-based solutions, which in large has replaced on-premises software. Companies such as Microsoft, Salesforce, Google, Amazon and Adobe had extensive capital expenditures allocated to developing products in this segment, which has been a major contributor to shareholders returns. Software firms typically obtain the highest valuation metrics relative to hardware firms due to the advantage of scaling products rapidly and

distribute their offerings digitally with relatively minor production costs associated with scaling (Drazdou, 2023). Furthermore, software firms can cross-sell products across a variety of segments when networks effects have been established. In sum, software firms are highly valuable when a broad user base is established, which offers M&A acquirers a potential for exponential profits. Hence, the synergetic gains are exponentially greater for large firms relative to smaller firms as they can utilise their large user base.

Other important characteristics within the U.S. software industry include short product cycles, therefore software companies are required to invest heavily in emerging technologies, R&D and attracting the best talent to attain the competitive edge and avoid being disrupted (Drazdou, 2023). Hence, firms employ the M&A strategy if the innovation rate and capital expenditures towards R&D is low to externally acquire future growth through the M&A market. Furthermore, acquiring technology firms provide the acquirer with direct access to valuable IP, patented technologies and copyrights (Drazdou, 2023). Therefore, M&A transactions within the software industry grew impressively with a CAGR of 17.7% from 2013 to 2021. Important drives for this surge in M&A transaction include accelerating the digital transformation, favourable market conditions with increasing interest of private equity firms and hedge funds, particularly SaaS companies have acquired the interest as potential targets (Drazdou, 2023).

Politicians have demanded forceful approaches of antitrust enforcement towards the IT-behemoths Amazon, Google and Meta. Amazon has a dominant market share and accounts for 40% of all ecommerce sales, Google and Meta combined account for 60% of digital ad spend in the United States in 2019.These technology giants have acquired hundreds of companies in their corporate history, which demonstrates their objective of maintaining the competitive edge and avoid disruption by new entrants (Katz, 2020). One of the contributing factors to their achievements is their usage of networks effects, they are developing products and services and are cross selling their new offerings directly to their existing user base. These properties lead to monopolistic market conditions where “winner-takes-it all”, therefore regulators have suggested breaking up the technology giants as a response to the monopolistic market conditions imposed by the technology behemoths (Katz, 2020). Furthermore, the technology giants are also favourable positioned for the future business environment because of their ability to manage and store big data, especially with the integration for artificial intelligence software to analyse and streamline date. In the recent decade, business models have continued their trajectory towards becoming more digitalized, which is estimated to further increase the appetite towards technology companies (Katz, 2020).

In summary, the distinctive characteristics of the U.S. software industry offer significant relevance in comprehending the factors impacting M&A endeavours.

Chapter 3

3.1 Theoretical Review

This chapter introduces and explores two distinctions of conventional economic theory: neoclassic and behavioral economics theory. The theoretical framework is derived from academic literature and aims to provide a thorough analysis of the underlying objectives from the acquirer's perspective to engage in M&A activity. The objective is to establish a theoretical foundation for understanding how micro- and macroeconomic factors impact the strategic choice for pursuing M&A activities.

3.1.1 Behavioral Economic Theory

To accurately examine the behaviour of M&A activity a behavioral perspective must be incorporated in this thesis. The neoclassic approach for engaging in M&A activity is a rather simplistic approach. Hence, to only participate in M&A activity when NPV>0 or when the synergetic gains can be estimated with a high level of certainty (Bruner, 2004). However, around 80% of M&A activity erode shareholder value implying congestive factors negatively impacting the rationality of managers and influencing the decision-making of managers (Bruner, 2004). Therefore, is it crucial to incorporate a behavioral viewpoint when studying the M&A activity in the U.S. software segment. The theories included in section 3.1.1 are managerial hubris, herding theory, agency theory and misvaluation theory.

Managerial Hubris

Hubris theory offers a behavioral perspective in explaining the behaviour of M&A activity. Richard Roll suggested that the driving force behind M&A activity is pride or said differently hubris of management, considerable evidence imply earning high returns from acquisitions is highly difficult (Bruner, 2004). Managers overconfidence in overestimating potential synergies resulting in excessive premium paid for acquisitions often result in wealth destruction for shareholders. Furthermore, a study of 106 large acquisitions found that CEO hubris is highly associated with the size of premium paid (Hayward et al, 1997). Furthermore, the relationship further strengthens when the CEO is chairman of the board, and the board has a high concentration of inside directors. In terms of synergy, the premium for an acquisition should reflect the expected synergy achieved, if management fails to integrate the acquisition it tends to lead to value-destruction (Hayward et al, 1997). The overly optimistic behaviour of management, where acquirers overpay for their target can be related to managerial empire building. However, a strong governance system of monitoring can forestall hubris (Bruner, 2004).

Herding Theory

To describe the behaviour of M&A activity which occurs in cyclical patterns, herding is a concept where investors and firms engage in overly optimistic behaviour in financial markets, such as the dotcom bubble. Herding thrives when macroeconomic conditions such as low cost of capital, rising stock prices and optimistic outlook towards the economy is present (Roll, 1986). Herding in terms of M&A occurs after the first successful takeover and other firms are mimicking the strategy of competitors and ignore rationale decision-making. A study conducted by Boston Consulting Group found evidence of shareholder returns in a weak-economy deals were 9% greater than mergers in a strong economy and generated positive returns on average (Kengelbach et al, 2018). Additionally, hubris and herding are closely related and in combination they are regarded as highly relevant factors for understanding the behaviour of the M&A waves.

Agency Theory

The two scholars to introduce and apply agency theory regarding shareholders and corporate managers was Jensen and Meckling in 1976. The agency relationship is defined as a contractual agreement between the principal and agent, with the principal being the shareholder and the agent being the manager (Jensen & Meckling, 1976). According to Jensen and Meckling, when the agent is maximizing their own utility there is a good reason to believe that the agent is not acting on behalf of the shareholders. However, the principal can establish appropriate incentives to limit the agent in performing value decreasing actions such as monitor the expenditures of the agent. According to Jensen and Meckling, the largest source of conflict arises when the manager's ownership claims falls, then his incentive to devote significant time in creating new profitable ventures decreases because it requires too much effort (Jensen & Meckling, 1976). Furthermore, manager's compensation package is often positive linked with firm growth, therefore managers are inclined to pursue M&A activity to expand their managerial empire also when NPV<0 (Bruner, 2004). Furthermore, managers are incentivized to pursue M&A with FCF instead of issuing dividend payments to shareholders or establishing share buyback programs, because it reduces the manager's funds under management and thereby power. This type of behaviour is defined as empire building, where managers maximize their own utility in expanding their empire and power without necessarily rewarding the shareholder in the process.

Misvaluation Theory

Misvaluation is a well-studied theoretical perspective which provides an important contribution in explaining the source of payment in the M&A waves. The two researchers Shleifer and Vishny developed a new theory, and the fundamental assumption is that financial markets are inefficient, and firms are valued incorrectly (Shleifer & Vishny, 2005). In contrast, managers are extremely rational, they understand stock market inefficiencies and capitalise on misvaluation through M&A (Shleifer & Vishny, 2005). This is a contradicting to the hubris theory, where the general assumption is that financial markets are efficient and corporate

managers irrational. Furthermore, empirical evidence suggests that acquirers employ stock as the primary source of payment when MTB ratios are high, and insiders are selling stock. In contrast, acquirers utilize cash as the primary source of payment when the acquirer is undervalued. The long-term return for the acquirer's shareholders in stock acquisitions are negative and the return is positive for the acquirer in cash transactions (Shleifer & Vishny, 2005). Hence, when financial markets are bullish such as in the 1990's and 1960's where stock market valuations were extremely high, and the acquisition currency was stock (Shleifer & Vishny, 2005). Furthermore, in 1990 the percentage of stock as acquisition payment was 24% and in 1998 the acquisition payment of stock peaked at 68% (Rhodes-Kropf & Viswanathan, 2005). Neoclassic theory's perspective on M&A is as an efficiency improving response towards industry shocks such as antitrust policy or deregulation (Shleifer & Vishny, 2005).

Rhodes-Kropf and Viswanathan departed from the view that managers are rational and financial markets are inefficient. They claimed that potential synergies are overvalued by the acquirer because of an overly optimistic economy characterized by elevated stock prices and a low cost of capital (Rhodes-Kropf & Viswanathan, 2005). Furthermore, they argue the rational manager of the target would be hesitant towards accepting the acquirer's overvalued equity as payment. Hence, it is highly difficult to determinate if overvaluation is a phenomenon of acquirers' high valuation or because of the expected synergies. Thus, when financial markets are overvalued, there is a higher probability that the target overestimates potential synergies associated with a merger. The theory is highly related to information asymmetry, where the most informed managers can capitalize on inefficiencies in financial markets. Managers can observe the direct effects on their business, but it is difficult to assess if it is firm specific or an industry wide phenomenon (Rhodes-Kropf & Viswanathan, 2005). In contrast, bidder's manager may have private information about the synergies which can be derived from the combination of the two entities (Trautwein, 1990).

3.1.2 Neoclassic Economic Theory

The core principle of neoclassic theory is the supply and demand mechanism, which affects price levels and the output of products and services in the economy. The main objective is to maximize profits and markets are presumed to be efficient and competitive. Furthermore, according to the neoclassic paradigm managers are rational (Bruner, 2004). In relation to M&A, managers are expected to only engage in M&A activity to enrich the shareholders of the entity. Furthermore, managers seek value-creating opportunities, which can be obtained through pursuing M&A activity through economics of scale, managerial efficiency, financial efficiency and market power (Bruner, 2004). The theories applied to examine the neoclassic paradigm: efficiency theory, market power theory, industry shock theory and economic prosperity theory.

Efficiency theory

From the neoclassic economics paradigm, synergies are frequently used as the rationale for why a merged firm is worth more than the two separate entities. Managers are often employing the synergy argument as argumentation for pursuing M&A deals instead of distributing the excess cash to shareholders. Trautwein presented the efficiency theory in 1990, the theory considers merges as being planned and executed with the purpose of achieving synergies. He categorizes three types of synergies: financial, operating, and managerial. The three types of synergies all relate to either cost reduction or revenue enhancement (Trautwein, 1990).

Financial synergies arises when the combined firm archives a lower cost of capital. According to Trautwein, this can be achieved by reducing the systematic risk of the firm by diversifying the revenue streams into unrelated businesses. Additionally, it can be achieved by increasing the company's size and lastly by establishing internal capital markets (Trautwein, 1990). However, financial synergies have obtained theoretical criticism from scholars, the main argument being in an efficient capital market, financial synergy cannot be achieved. Researchers has not found evidence of lower systematic risk or superior access to internal capital markets, but the size advantage argument seems to exist regarding favourable access to capital markets (Trautwein, 1990).

The second source of synergy stems from operational factors and can be obtained through horizontal mergers. Operational synergies can be achieved through cost efficiencies such as a joint sales force or transferring information across units. Furthermore, the combined entity may be able to offer unique products or services (Trautwein, 1990). Furthermore, Operational synergies are triggered in horizontal mergers where the combined entity achieve economies of scale and scope. Porter performed a study in 1987, he found that more than half of acquisitions by major U.S. companies failed. Additionally, he found that acquisitions in related business outperformed acquisitions in unrelated industries (Trautwein, 1990).

The last source of synergy is Managerial efficiency synergy and is realized when the acquirer's management process superior planning and monitoring abilities relative to the target's management (Trautwein, 1990). The fundamental premise for managerial efficiency theory is that a high positive correlation between managerial efficiency and the market price of the shares, for this assumption to be accurate capital markets are efficient and asset prices are priced correctly. Hence, a poorly managed corporation will experience a decline in the underlying share price relative to industry peers. The low share price provides an incentive where a competent management team can acquire the inefficient firm's assets inexpensively and returns from acquiring a poorly managed company can be enormous (Manne, 1965).

In summary, the importance of different sources of synergies are highly important when studying M&A activity. As corporate managers employ the synergy argument as the rationale for performing M&A.

Market Power Theory

Market Power Theory suggests that corporations merge to improve their competitive position in their respective industry by controlling prices within the industry. Michael Gort presented the market ower theory (1963), which examines industry concentration and stability in market share. According to his study, the factor which ultimately determinate industry concentration is the ability to earn abnormal profits. Stability in market share occurs when demand and innovation is stagnant (Gort, 1963). The empirical results indicate that the level of industry concentration declined in industries with high profit rates. Furthermore, industries with a few large corporations with substantial market power, their market share were stable because of economics of scale and product differentiation (Gort, 1963) Additionally, Horizontal mergers provide competitive advantages by reducing industry concentration and enforce greater economies of scale. Thus, a reduction in industry concentration and a larger market share of the combined firm increases the ability to control the price level within the industry and increase profits. In stagnant industries, firms who seek to expand will experience increased competition and pressure prices downward, therefore growth in stagnant industries stems from acquisition of existing property (Gort, 1969).

Industry Shock Theory

Another important driver of M&A activity is industry shocks which explain the clustering behaviour of merger waves in certain industries. Gort presented the economic disturbance theory (1969), in which economic shocks alter the structure and future expectations of industries. The theory argues that the three most important factors for industry shocks are rapid changes in technology, rapid movements in security prices and industry growth which alter the future expectations for the industry (Gort, 1969). Furthermore, Gort argues that in industries where barriers of entry are high, firms are more likely to merge. In contrast, in industries where barriers of entry are relatively low firms can establish production capacity internally. Also, when firms require additional capacity due to industry growth, they have two options, they can acquire additional production capacity externally or create new production facilities internally. The latter is a lengthy process for increasing production capacity meanwhile competitors and new entrants can supply the increase in demand, therefore acquiring existing production facilities are often facilitated by managers through the M&A market (Gort, 1969).

Furthermore, the two scholars Mitchell and Mulherin studied the fourth M&A wave to understand the mechanics behind M&A waves clustering in certain industries. They found empirical evidence of industries with the greatest M&A activity are responding to deregulation, technological advancements, growth and

changes in demand and supply conditions, which encourages managers to expand internally or externally to capitalize of the new business environment (Michell et al, 1996). They found that industries which experienced the greatest amount of M&A activity were those exposed to the largest fundamental shocks which trigger a M&A wave within the specific industry. Additionally, their results suggest that a joint effect of macroeconomic and microeconomic factors must be integrated in the modelling of M&A activity. In support of (Mitchell & Mulherin, 1996 & Gort, 1969), Harford (2005) found evidence of economic, regulatory, and technological shocks drive merger waves. His contribution to academia, was whether the shocks lead to merger waves highly depend on overall liquidity in the capital markets to accommodate the asset reallocation of firms. Furthermore, merger waves require a combination of economic motivation and relatively low transaction costs to generate M&A waves (Harford, 2005).

In sum, Gort (1969) presented that industry shocks alter the future expectations of industries which explain the reasoning behind the clustering of M&A activity. Mitchell and Mulherin (1996) found that managers respond to industry shocks by investing internally or externally through M&A to fit the new business environment imposed by the industry shocks. Harford (2005) found that liquidity in capital markets is crucial to finance the reallocation of assets.

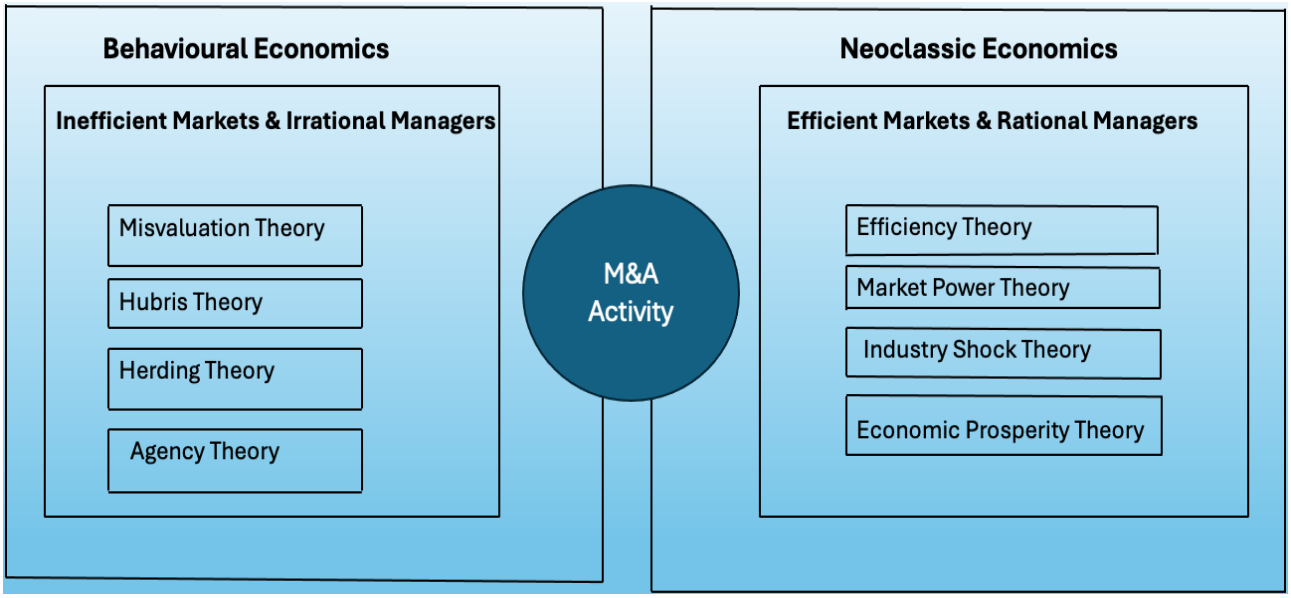
Economic Prosperity Theory

This theory provides a theoretical foundation for why M&A activity are positively associated with macroeconomic factors (Melchier et all, 1983). They provided an extension to previous literature and discovered the positive correlation between stock prices and M&A activity (Melchier et all, 1983). Furthermore, they found evidence of the capital market hypothesis cannot be rejected, changes in the stock market and bond yields can be utilized to forecast M&A activity. Furthermore, they employed a univariate time series model and found that negative correlation between M&A activity and interest rates. When examining the macroeconomic environment in the previous M&A waves, elevated stock prices and favourable asceses to capital were all present in the previous waves visualized in table 1. They also found evidence of industrial production provides an indicator of economic activity which influences M&A activity (Melchier et all., 1983). A high concentration of M&A transactions are financed through corporate debt, implying NPV of future cash flows are significantly affected by the cost of capital. Furthermore, according to neoclassic theory stock prices provide as a determinant of future economic growth. When corporations experience demand constraints, they acquire additional capacity internally or externally through M&A (Harford, 2005). In sum, macroeconomic factors are a crucial component of M&A. The attractiveness of M&A is highly depended on the cost of capital and the economic prosperity.

3.2 Summary

Figure 7 demonstrates a visualization of the eight theories presented in section 3.1. The theoretical framework for the thesis contains micro- and macroeconomic variables to examine the underlying drivers of M&A within the U.S. technology industry. Furthermore, prior literature highly suggests the importance of incorporating multiple variables to accurately examine M&A activity.

Figure 7: Theoretical Framework to study M&A



Source: Own Creation

Chapter 4

4.1 Literature Review

This section presents previous empirical findings from the examination of behavioral and neoclassic economics theory from the most respected scholars within the fields of M&A. Furthermore, the academic literature presented provides the rationale for the why the inclusion of micro- and macroeconomic factors is crucial for accurately examining the M&A activity.

4.1.1 Behavioral Economic Theory

This section presents the empirical models and results from the behavioral literature's perspective in relation to the four theories presented in chapter 3.1.1.

Managerial Hubris

One of the most prominent scholars studying the hubris theory in relation to M&A activity is Richard Roll (1986). Roll argues that capital markets are semi-strong efficient and asset prices reflect all information of individual firms. Hence, the average takeover premium is caused by valuation error and hubris instead of potential synergies. The methodology Richard employed to empirically test hubris hypothesis is the share price fluctuations (Roll, 1986). Furthermore, Roll argues that the average target's share price would surge on the announcement of an offer and decline if the bid is unsuccessful. Richard refers to Asquith's (1983) study of target firms in unsuccessful merger deals, which found that target firms were accompanied with a 7% average increase in market value after the preliminary merger bid was announced. However, the increase in share price was entirely reversed within 60 days, the target's share price declined to 8.1% after the expiration date of the final offer. Furthermore, Asquith's found that successful acquirer's experience a positive correlation between share price and announcement of acquisition, and a negative relationship between the share price and unsuccessful bids. Asquith's results were conflicting towards the results of Dodd (1980), he found significant negative returns for the acquirer after the announcement of a successful deal. The empirical results are ambiguous as hubris predicts the combined value of the target and bidder should fall slightly.

These discoveries were expanded by Hayward & Hambrick (1997), in addition to the acquirer's stock performance they included the recent media praise and the self-importance of the CEO, they also included a composite factor of the three variables (Hayward & Hambrick, 1997). They examined the acquisitions of 106 large publicly traded firms with transaction values above 100 million dollars from 1989 to 1992. They employed a multiple regression analysis to examine hubris and their findings were similar to the Richard Roll's discoveries. Their results imply that CEO self-confidence and recent stock performance of the acquirer is highly associated with the premium paid for the acquisition. Overconfident managers tend to overestimate the

expected payoff from their uncertain M&A endeavours. Premiums and hubris have no effect on immediate shareholder return but are negatively related to one-year post acquisition (Hayward et al, 1997) However, a strong governance system of monitoring can forestall the overly optimistic behaviour of managers (Bruner, 2004).

The previous literature has supported the consensus of overconfident managers erode shareholder value through M&A activity. An opposing view stems from Hirshleifer, Low and Teoh (2012) according to their finding's overconfidence helps CEOs exploit innovative growth opportunities and maximize shareholder value (Hirshleifer et al, 2012). Their theoretical research from 1993 to 2003 found that managers overconfidence can benefit shareholders by increasing investments towards uncertain risky projects with high expected payoffs. Furthermore, firms with overconfident managers experience greater return volatility, larger capex towards innovation, research and generally obtains more patents than risk-adverse managers. However, overconfident managers superior performance is only achieved in innovative industries (Hirshleifer et al, 2012). Therefore, it will be highly interesting to examine the hubris theory in a period consisting of 25 years and three separate M&A waves. In sum, widely respected scholars have studied the hubris theory with ambiguous empirical results, suggesting that the empirical results are highly depended on the scope, variable selection and period of investigation.

Herding theory

Herding theory provides the rationale from a behavioral perspective why M&A activity is clustering in specific industries. Bouwmann, Fuller and Nain (2009) conducted a study to investigate whether acquisitions occurring high-valuation markets are fundamentally different from acquisitions during a low-valuation markets, and ultimately the effect on shareholders returns in the years following the M&A endeavours. Although announcement returns in high valuation markets are significantly higher than those in low-valuation markets. Acquirers in high valuation markets significantly underperform acquirers in low-valuation markets in the following two years, which is consistent with existing theory (Bouwmann et al, 2009). They employed a multivariate regression framework to control for various factors that may affect the performance of the acquirers including payment method, type of transaction and acquirer's market-to-book ratio. Their results strongly indicate that acquisitions during highly optimistic markets are of lower quality and acquisitions in depressed markets are of higher quality. Furthermore, their results indicate that M&A activity is explained by herding behaviour of managers who undertake acquisitions late in the cycle when valuations are excessive (Bouwmann et al, 2009). Furthermore, a study conducted by Boston Consulting Group (2018) found that strong-economy deals on average destroyed shareholder value over a two-year period and returns from transactions during a weak-economy were 9% greater than deals in high-valuations and on average generated positive returns to shareholders (Kengelbach et al, 2017). In sum, for herding literature regarding M&A activity

evidence was found that M&As during high valuation markets has a high probability for eroding shareholder value.

Agency Theory

Agency theory is a widely discussed topic among researchers across academic literature including within M&A. Jensen and Meckling (1976) introduced the agency theory in relation to M&A and according to their theory, when managers maximize their own utility issues are prone to arise (Jensen & Meckling, 1976).

Researchers Amihud and Lev (1981) initiated a study to examine the motive behind companies engaging in conglomerate M&A activity and their research scope was the third M&A wave. Their hypothesis was that managers pursued a conglomerate merger strategy to reduce the risk of the combined entity. The rationale behind pursuing a conglomerate M&A strategy was to diversify income streams and thereby avoid the risk of bankruptcy and unemployment (Amihud & Lev, 1981). The self-interested behaviour of managers does not necessarily maximize shareholder value because shareholders can obtain diversification through investing in different asset classes and across industries. They applied a Tobit test to construct the analysis, their findings support the hypothesis that managers engage in conglomerate M&A activity to reduce unemployment risk and thereby for personal motives rather than maximizing shareholder value (Amihud & Lev, 1981).

Another indicator for managerial empire building is management's employment of FCF. In 1999, Harford empirically examined whether cash-rich firms engaged in M&A to a higher extent than cash-poor firms from 1977 to 1993. He found sufficient evidence of cash-rich firms did pursue M&A to a higher extent than their counterparts (Harford, 1999). Furthermore, he also found that cash-rich acquirers experienced an abnormal decline in operating performance following an acquisition. An additional reason which explains managers engage in M&A is their compensation package is often positively linked to firm growth, therefore managers are inclined to pursue M&A with excessive free cash flow instead of returning capital to shareholders through issuing dividends or buy-backs (Bruner, 2004). Hence, returning capital to shareholders reduces asset under management and thereby the power of the manger, which support the thesis of managers accumulate resources to expand their managerial empire (Trautwein, 1990). In sum, scholars within agency theory unanimously agree that personal incentives of corporate managers have historically led to irrational managerial behaviour and shareholders have suffered devastating losses following the reckless behaviour of managers.

Misvaluation Theory

The primary theories regarding overvaluation theory were developed by Shleifer and Vishny (2003) and Rhodes-Kropf, & Viswanathan (2005). Their theories provide a theoretical framework for explaining M&A activity from a valuation standpoint.

Two of the first scholars to examine M&A activity in relation to the overvaluation perspective was Shleifer & Vishny (2003). According to their theory, financial markets are inefficient in relation to valuing security prices accurately and investors wrongly value securities according to the sentiment towards a group of stocks or industries. Furthermore, overvaluation provides a powerful incentive to exercise acquisitions with stock as the source of payment while firms with relatively less overvalued equity become takeover targets (Shleifer & Vishny, 2003). To empirically examine whether high-valuation firms acquire relatively less overvalued firms, Kropf and Viswanathan (2005) conducted a study of public listed firms utilized MTB ratio as the determinant of valuation. Their findings indicate targets are more likely to overvalue the offer the greater the market overvaluation becomes even though the target's stock is impacted by the same overvaluation to a relatively less extent, thereby indicating that the management of the target made a valuation error when accepting the offer. Furthermore, misvaluation also influences the source of payment and overvalued acquirers prefer stock acquisitions. Hence, cash acquirers are on average less overvalued that stock acquirers. They also provide a revealing example in relation to the dot.com era, in 1990 the percentage of stock acquisitions was 24% and in 1998 stock acquisitions peaked at 68% (Rhodes-Kropf & Viswanathan, 2005).

A similar study constructed by Fu, Lin and Officer (2011) confirmed the results of Rhodes-Kropf & Viswanathan (2005). They investigated acquisitions completed between 1985 and 2006 with deal value above 10 million USD and the source of payment was registered as either stock or cash deals. To perform the investigation, they employed return on asset (ROA) to study the performance. The empirical findings suggest that overly optimistic periods of rising stock prices and liquidity in financial markets the primary source of payment was stock, and when markets are depressed acquirer's preferred payment method was cash, which is aligned with existing theory. Furthermore, they found that significantly overpaying for the target negatively effects the long-run operating performance of the acquirer. Hence, their evidence suggests that the acquirer would be better off if they did not pursue M&A with overvalued equity (Fu et al, 2011).

A slightly different approach, challenging the neoclassic perspective towards M&A was developed by Gugler, Mueller and Weichselbaumer (2012). They argued that if M&A activity was directly correlated to the underlying economy both public and private firms would experience a M&A wave, as neoclassic theory argues that waves emerge as a respond to external shocks. The study was conducted in the United States, United Kingdom and Continental Europe from 1991 to 2004. As anticipated, they found that listed companies' share price peaked as the M&A wave peaked and they applied the (P/E) ratio to as proxy for valuation. They discovered, as firms became increasingly more overvalued private firms' participation in the wave decreased substantially because private firms cannot utilize equity as payment. This behaviour was highly expected from the behavioral economics paradigm but is inconsistent with the neoclassic theory (Gugler et al, 2012).

In summary, the empirical findings regarding misvaluation theory, suggests that a behavioral perspective must be incorporated in addition to neoclassic economics theory to accurately examine M&A activity. Furthermore, empirical evidence suggest that M&A activity is influenced by microeconomic factors, which stems from market inefficiencies and irrational managerial decision-making.

4.1.2 Neoclassic economic theory

This section presents the empirical models and results of academic literature in relation to the neoclassic economics paradigm. The fours theories are presented in section 3.1.2.

Efficiency Theory

At the firm level, Gorton et al, (2009) argued that in anticipation of M&A waves firms acquire relatively smaller firms as a defensive strategy to avoid being acquired by a larger entity. Thereby indicating that M&A dynamics are highly related to firm size, especially in industries where economics of scale is archivable. They conducted the investigation through a regression analysis, and their findings support the theory of firms engaging in acquisitions to increase in size and reduce the likelihood of being acquired by a larger entity. An alternative theory suggest that firms engage in M&A to increase in size to position themselves as more attractive takeover target. Furthermore, they found that large acquirers typically pay a premium and thereby engage in unprofitable M&A activity. In contrast, small acquirers tend to engage in profitable M&A. Overall, according to their findings, the arms race for firm size often leads to profitable acquisitions and their theory contribute to explaining why M&A waves are concentrated in industries (Gorton et al, 2009). However, substantial evidence contradicts their findings that firm size leads to profitable acquisitions as 80% of acquisitions lead to negative shareholder returns (Kengelbach et al, 2017).

Similarly, researches Danzon, Epstein and Nicholson (2007) studied M&A activity within the U.S. pharmaceutical and biotechnology industry from 1998 to 2001. They conducted the study through a multinomial regression model, and their discoveries suggest that large firms with a low MTB ratio which indicates conservative growth rates are more likely to engage in M&A to secure long-term growth opportunities and realize operational synergies. Furthermore, expected excess capacity and patent expirations enlarged the incentive for large firms to pursue M&A deals. In contrast, small firms in financial trouble proxied by low a cash/sales ratio engage in M&A as an exit strategy to avoid bankruptcy and liquidation of assets. In contrast, smaller firms with a high cash/sales ratio are more inclined to remain independent and thereby less likely to engage in M&A activity (Danzon et al, 2007). Their findings support the managerial efficiency motive that large firms have lower debt, higher capacity utilization and management in large firms are more efficient

in allocating and maximizing resources compared to management of smaller firms, indicating that M&A increases the overall efficiency (Andrade & Strafford, 2004).

The intangible asset ratio is also highly relevant in explaining M&A in the technology industry because of the opportunity to gain strategic assets, intellectual property and patents. Blonigen and Tayler (2000) studied the relationship between R&D intensity and acquisition activity in the U.S. electronic and electrical equipment industries from 1989 to 1994. To examine the relationship, they employed a negative binomial regression model, and their results indicate a strong negative correlation between R&D intensity and acquisition activity. Hence, firms with relatively lower R&D Capital expenditures are more likely to participate in the M&A market (Blonigen & Tayler, 2000). In line with the empirical findings of Hall (1987), according to his discovery's, firms employed an internal growth strategy of allocating resources towards R&D intensity versus an external acquisition strategy. An external growth strategy is especially concerned with creating synergic gains between the target and acquirer (Hall, 1987). Firms with a 5 percent higher Capex R&D intensity have approximately a 26 percent lower yearly acquisition rate (Blonigen & Taylor, 2000).

In sum, the empirical results presented in this section underlines the importance of considering firm-specific variables when examining the motives behind M&A.

Market Power Theory

The first scholar to present the market power motive as an incentive to pursue M&A was Gort (1969), he regarded M&A as firms attempt to reduce competition and secure a dominant position with the ability to control the price level.

Gugler et al, (2013) performed a study to investigate the performance of merged companies versus non-merging companies. Their results suggest that mergers on average result in significant increase in profits but reduced the overall sales of the combined entity. Furthermore, conglomerate mergers performed significantly worse than horizontal mergers. They also found that firms of larger size prior to the transaction increased profitability and thereby their market power significantly, indicating market power provides a significant motive for pursuing M&A. In contrast, firms of smaller size also performed better because of synergic gains regarding managerial efficiency. Their results share the same characteristics across industries and between domestic and cross-border mergers (Gugler et al., 2013). Michell and Mulherin (1996) findings from the 1980's takeover wave suggest that takeover waves stem from industries reacting to external shocks such as deregulation, antitrust regulations, increased foreign competition, financial innovations and commodity price fluctuation as opposed to the market power motive (Michell & Mulherin, 1996). Moreover, Komlenovic et al,

(2009) found evidence of a low industry concentration implies a higher potential market share for an acquirer, which increases the probability of M&A occurring (Komlenovic et al, 2009).

In sum, the literature provides ambiguous results in relation to the market power motive and M&A activity. Therefore, it will be highly interesting to examine the motive behind M&A activity from a neoclassic standpoint.

Industry Shock Theory

Gort (1969) presented the disturbance theory in which industries' operating environment is affected by economic shocks altering the attractiveness of industries. Furthermore, he performed a multiple regression analysis and found technological change, growth in demand and the stock market as significant drivers for M&A in the U.S. manufacturing industry during the third M&A wave (Gort, 1969). A broad industry wide study of 51 industries was conducted by Mitchell & Mulherin (1996), they studied the corporate takeover wave in the 1980's. They performed a regression analysis across industries and found that M&A was clustering in industries which experienced the greatest economic shocks. Examples of shocks with the greatest magnitude in the 1980's were deregulation, changes in input cost and rapid innovation in financing which induced alteration in certain industry structures (Mitchell & Mulherin, 1996). Their empirical results clearly illustrate the importance of incorporating industry-level variables and an industry focus to ensure an extensive empirical analysis. To construct the regression model, they utilized sales growth and employment growth as proxies for industry performance and found that both factors had significant positive explanatory power in relation to takeover activity (Mitchell & Mulherin, 1996).

Consistent with previous neoclassic literature of M&A activity, Harford (2005) also suggested that industry shocks cause firms to facilitate mergers to comply with the new altered business environment as previously stated. However, Harford's contribution to academia is that the economic shocks exclusively are not sufficient to accommodate an asset reallocation, whether the economic shocks lead to a M&A wave is highly depended on the overall liquidity in financial markets. The following neoclassic variables were employed to measure economic shocks: profits, asset turnover, R&D, Capex, employee growth, ROA, sales growth and the median absolute change for each variable was computed for each industry-year. Furthermore, Harford employed a logistic regression model, the results indicate economic shocks combined with sufficient liquidity significantly impact the probability of M&A waves occurring (Harford, 2005).

In summary, the academic literature presented highly emphasis the economic shocks importance as a crucial determinant of M&A, and therefore validate the importance of examining industry- and firm specific variables when examining overall M&A activity. However, the methodology for testing economic shocks differs among

researchers. Nevertheless, the inclusion of factors representing industry shock theory are critical when examination M&A waves.

Economic Prosperity Theory

To study the relationship between macroeconomic factors, influence towards M&A activity for U.S. industrial industries, Melchier et al, (1983) employed a time series analysis and cross-correlation matrix and discovered a positive correlation between M&A activity and the underlying economy proxied by the S&P500. Furthermore, the capital market condition proxied by interest rates was inversely correlated with aggregate M&A activity, which supported the capital market hypothesis (Melchier et al, 1983). This research provides empirical evidence of considering macroeconomic factors such as rising stock prices and interest rates when examining the determinants of M&A activity (Melchier et al, 1983). M&A transactions are frequently financed through corporate debt. Therefore, declining interest rates results in higher (NPV) of investments as the cash flows are discounted by lower levels of interest rates. Furthermore, in neoclassic theory the stock market functions as a determinant of future economic growth. When companies experience demand constrains, they have the option to acquire additional capacity externally through the M&A markets (Harford, 2005). Similar results were discovered by Shleifer and Vishny (2003) and Gort (1969), demand for M&A deals are high when the stock market is highly valued.

In a recent study, Choi and Jeon (2011) studied the macroeconomic determinants of M&A activity in the U.S. from 1980 to 2004 through a multiple regression model using quarterly observations of deal volume. Their results follow the broad consensus that GDP, stock prices, monetary policy and corporate liquidly represent a vital predictor of U.S. M&A activity. A suitable proxy for the capital market condition is the corporate spread, a wide corporate spread indicates a higher perceived risk (Choi & Jeon, 2011).

In sum, prior academic literature shares the broad consensus of macroeconomic factors exhibit significant explanatory power towards M&A activity. Furthermore, the historical review of M&A waves presented in section 2.2, the previous waves share identical patterns of favourable economic prospects containing high GDP growth rates and a favourable monetary policy. Hence, variables representing the capital market condition and economic prosperity must be incorporated in the investigation of the U.S. software industry.

4.2 Summary

Table 2 presents the empirical findings of the most prominent scholars within M&A. Furthermore, the theoretical framework consists of four behavioral and neoclassic economics theories. As presented in table 2, it is evident that most of the scholars study their scope with only microeconomic or macroeconomic variables. This project aims to contribute to academia through a combination of micro- and macroeconomic variables to determinate which factors evidently drive M&A in the U.S. technology industry from 1994 to 2019.

Table 2: Literature Review

Authors	Theoretical Framework	Research Focus	Econometric Method	Micro/Macroeconomic Scope	Period of Study	Proxy	Main variables	Results
Hayward & Hambrick (1997)	Behavourial Managerial Hubris	Large U.S. public acquirers	Multiple Regression Analysis	Microeconomic	1989 to 1992	Acquisition Premium	Acquirer performance media praise of CEO measure of CEO self-importance	The results spport that acquisition premium paid is related to CEO Hubris
Bouwman, Fuller & Nain (2009)	Behavourial Herding	U.S. public acquirers	Multiple Regression Analysis	Microeconomic	1979-2002	Deal Volume	Stock performance of acquisitions in optimistic and depressed markets	Empiricial evidence of acqusitions in low markets significantly outperform the other
Harford (1999)	Behavourial Agency Theory	U.S. public acquirers	Multiple Regression Analysis	Microeconomic	1977-1993	Deal Volume	Cash/sales ratio MTB-ratio Cash/total assets	Support of the hypothesis: cash rich firms enage more in value decreasing M&A
Rhodes-Kropf, Robinson & Viswanathan (2005)	Behavourial Misvaluation	U.S. public acquirers and targets	Multiple Regression Analysis	Microeconomic	1978-2002	Deal Volume	MTB-ratio	Cash acquirer are less overvalued than stock acquirer
Bloningen & Taylor (2000)	Neoclassic Efficiency Theory	U.S. high-technology industries	Multiple Regression Analysis	Microeconomic	1985-1993	Firm's total assets	R&D intensity Return on sales Cash flow	Results indicate an inversere relationship between R&D spending and acquisition activity
Gort (1969)	Neoclassic Market Power Theory industry shock theory efficiency theory	U.S. manufacturing industries	Multiple Regression Analysis	Microeconomic	1951-1959	Numbers of mergers vs firms within the industry	Firm size Industry concentratio industry growth	Support: M&A is a result of industry shocks and partly support as market power motive
Melchier, Ledolter & D'Antonio (1983)	Neoclassic Economic Prosperity Theory	U.S. Manufacturing and Mining industry	Time series analysis	Macroeconomic	1944-1977	Deal volume	Production S&P Index Bond Yields	M&A activity posetively correlated with the stock index and negatively correlated with bond yields
Harford (2005)	Neoclassic Industry Shock Theory	Broad study across U.S. industries	Multiple Regression Analysis	Micro- & macroeconomic	1981-2000	Deal Volume	Asset turnover MTB-ratio ROA	The evidence support that shocks can cause a M&A waves. But liquidity must be present for the shocks to propagate a wave

Source: Own Creation

Chapter 5

5.1 Data Selection

The data for this thesis was primarily collected from two databases: FactSet and Federal Reserve Economic Data (FRED). FactSet is an American financial data and software company containing company financials, M&A deals and a variety of financial metrics. FactSet has provided all the company specific data of the acquirer and M&A deals incorporated in the thesis. Furthermore, FactSet is a reliable source for company specific data which ensures a high data quality for this thesis.

The other database FRED was used to collect macroeconomic data and is a highly trusted source for economic data since the 1960's. The database was used to collect data for GDP, 10-year treasury rate and corporate spread, these macroeconomic data are of high importance for this thesis as previous scholars found empirical evidence of these factors impact on overall M&A activity. However, S&P500 data was collected from Yahoo finance. When considering the databases utilized for this thesis, the sources are of high validity, which ensures the quantitative data is trustworthy and reliable.

Since M&A activity historically has fluctuated across time, it is evident that M&A activity has clustered in certain periods. Therefore, to accurately examine and capture the determinants of M&A activity, the sample period selected for this thesis is 27 constructive years from 1992 to 2019, excluding the effects of COVID-19. This should ensure a representative analysis of three M&A waves: the dot.com bubble (1992-2000), period leading up to the financial crisis (2003-2007) and the period from 2011 to 2019. However, the first observation occurs in Q1 1994. Therefore, the sample period of this thesis is altered to contain 25 constructive years from 1994-2019. The data stems from 290 observations which is gathered into a total of 92 quarterly observations.

In the data utilized for this project, several selection criteria were applied in FactSet.

1. **Acquirer and target are both operating in the U.S:** This project has only considered companies operating in the United States. This focus eliminates the need to control for country specific macroeconomic variables that would arise if worldwide acquirers were included in the sample. Furthermore, the depth of historical M&A data within the U.S. software industry is more accessible and trustworthy than the rest of the world. However, FactSet did include non-U.S. acquirers in the sample, which were detected and removed from the sample.

2. **The Acquirer is publicly listed at the time of transaction:** Since this project requires substantial firm-specific data only public acquirers and targets were considered to ensure the necessary data was obtainable.

3. **The acquirer can operate in any industry:** No industry criteria was required for the acquirer, because it would decrease the sample size and because it is interesting to examine the broadly based determinants of M&A activity in the U.S.

4. **The target is a publicly listed software company:** Since the scope of this thesis is to examine the M&A determinants within the U.S software industry, the target must be classified as a U.S. software-related company. The following industries were selected: Packaged software, internet software/services, information technology services, semiconductors and electronic distributors. The rationale for only considering public targes was because they contain a greater level of financial information than private companies, but the firm-specific data of the targets were relatively limited. Hence, only firm-specific information of the acquirer is incorporated in this project due to information availability.

5. **Information regarding deal type and transaction value:** The transaction value must exceed a transaction value of at least 5 million USD to be considered in this project which will ensure that the management is involved in the transaction.

6. **Transaction must be completed:** The last selection criteria is the transaction must be completed to be included in the sample. Furthermore, only M&A transactions were included in the sample. Excluding deals classified as minority stake, spinoffs, leveraged buyouts exchange offers, recapitalizations and privatizations were excluded for the sample.

Following these selection criteria presented in section 5.1 FactSet provided a sample size of 599 observations. The final sample was reduced to 290 observations and table 3 presents a three-step approach for removing deals.

Table 3: Data sampling revision

Step	Data sampling revision	Observations
Original sampe from Factset		599
1	Removing deals with missing values	
2	Removing deals with non-U.S. acquirers	
3	Removing delas with accounting errors	
final sample		290

Source: Own creation

In the final sample, 189 of the deals involved horizontal acquisitions meaning the acquirer was classified as a software company, and in 101 of the deals the acquirer operated in an unrelated industry. Therefore, the sample is a little skewed towards horizon acquisitions.

Table 4: Sample classification

Target industry	Observations
Packaged Software	167
Information Technology Services	86
Internet software/services	27
Electronics distributors	9
Semiconductors	1
Total	290

Source: own creation

As illustrated in the table 4, 57% of the targets were classified as packaged software-related firms, 30% of the firms were classified as information technology service firms and 13% of the target firms operated in the last three industries. Since, the scope of this project is to examine determinants of M&A activity form the acquirer's perspective the industry of the target is less important for this thesis.

Table 5: Presentation of M&A transactions

Period	Observations
1994-2000	86
2001-2002	44
2003-2007	68
2008-2010	39
2011-2019	53
Final observations	290

Source: Own Creation

As presented in table 5, The distribution of the sample is skewed towards the dot.com bubble which contains 29.5% of the total observations. Afterwards, the period leading up to the financial crisis encompass 23.4% of the observations. The M&A wave post the financial crisis contains 18.2% of total observations and 28.6% of the M&A transactions within the sample are categorised as not in a M&A wave. In sum, the dot.com bubble and the period prior to the financial crisis has the highest concentration of observations and therefore, the empirical findings of this paper are the more representative towards these two waves.

The objective was to examine the determinants of U.S. M&A activity within the software industry. Hence, the population sample were all firms fulfilling the criteria's presented in section 5.1. However, 52% of the observations of the original sample were removed due to factors listed in table 3. Only testing 48% of the observations could negatively affect the validity of the project and cause sample selection bias. However, the sample for this thesis is significantly broader than previous empirical studies within M&A (Gort, 1969 & Hayward et al, 1997). Furthermore, the period of investigation is 25 years and includes three M&A waves which should provide reliable results. In section 3.1, most of the prior studies were significantly shorter and only three scholars performed empirical studies longer than 20 years (Bouwmann et al, 2009 & Rhodes-Kropf et al, 2005 & Melchier et al, 1983).

5.2 Variable selection

This section presents the dependent and explanatory variables included in this thesis to examine M&A activity within the U.S. software industry.

5.2.1 Dependent variable

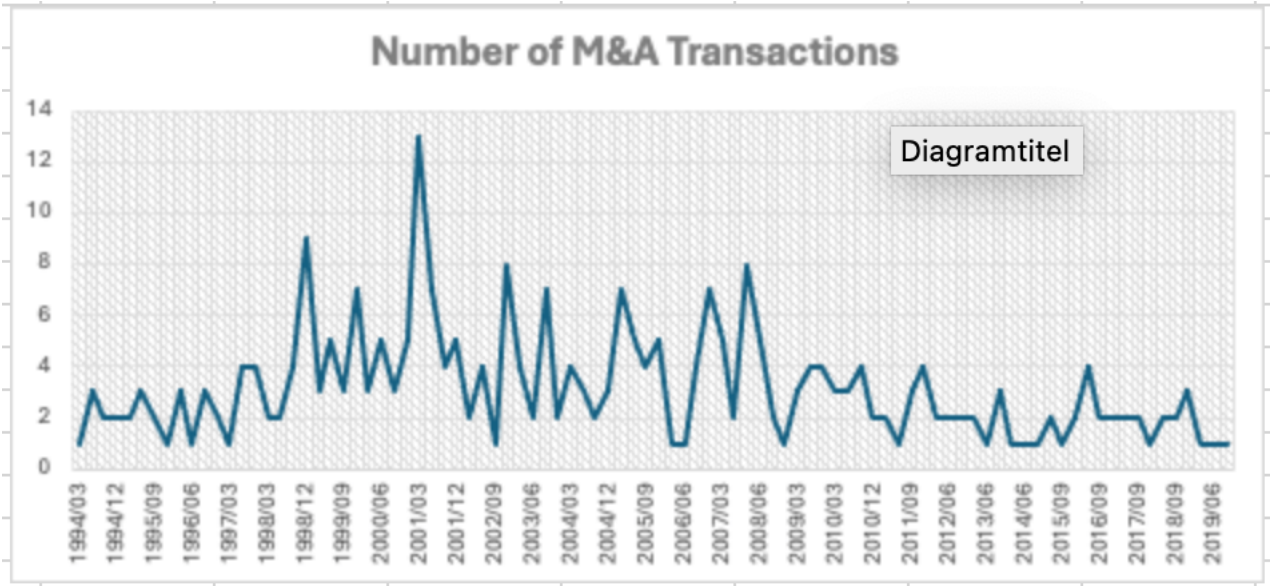
The purpose of this thesis is to empirically examine micro- and macroeconomic factors impact towards M&A activity in the U.S. software industry from 1994 to 2019. Prior literature conducted their studies employing either deal volume or deal value as a proxy for M&A activity. The rationale for selecting deal volume as proxy for M&A activity is that all deals are weighted equally, and therefore excluding periods of extreme overvaluation to negatively affect the results (Bruner, 2004). Furthermore, most of the empirical studies in the literature review has used deal volume as proxy for M&A activity (Bouwmann et al, 2009 & Rhodes-Kropf et al, 2005 &Harford, 2005 & Melchier et al, 1983).

Deal Volume

The rationale for employing deal volume as proxy for M&A activity within the U.S. software industry is the straightforward understanding of the variable, all deals are weighted equally (Bruner, 2004). Deal volume is constructed by aggregating the M&A transactions into quarterly observations throughout the sample period, the reason for selecting the mean of the quarterly observations instead of yearly observations is the advantage of a longer dense sample period. Furthermore, this should increase the predicative quality of the regression model and the sample period is composed of 92 quarterly observations. The methodology of applying quarterly observations follows previous literature in studying M&A activity (Melchier et al, 1983 & Choi & Jeon, 2011). As illustrated in figure 8, deal volume in the U.S. software industry experienced a rapid appreciation of M&A transactions in the period leading up to the dotcom bubble, which was expected as firms sought to rapidly integrate software firms into their internal ecosystem. Furthermore, in the period prior to the financial crisis

deal volume began to surge again with serval significant spikes in the period. However, after the financial crises deal volume has been on a relatively decreasing trajectory with serval smaller spikes in the period.

Figure 8: Number of M&A transactions completed (1994-2019)



Source: Own Creation, FactSet

5.2.2 Independent Variables

The explanatory variables were selected based on the eight theories selected presented in selection 4.1 and 3.1. The independent variables are crucial for this thesis as they provide to ability to empirically test the micro- and macroeconomic determinants of M&A activity in the U.S. software industry. Additionally, the empiric results from previous studies will also be presented in this section.

Managerial Hubris and Herding Theory

To examine the wealth-destroying behaviour of managers these two theories were combined to examine M&A activity. As explained in section 3.1, herding is where firms engage in M&A activity as a response to competitors engaging in M&A and hubris is where overconfident managers pay substantial premiums to expand the managerial empire. The methodology applied for testing the two theories is the acquirer's stock price 1 week prior to the announcement of the acquisition and the stock price two years after the acquisition (Hayward & Hambrick, 1997). Furthermore, this project applies logarithmic return instead of simple return to measure the percentage change in the two-year period. Previous literature has applied premium paid to examine hubris, which is the difference between book value and market value.

Agency Theory

To examine the self-interested behaviour of corporate managers the cash-ratio was employed. As explained earlier, managers have been argued to use excessive free-cash flow to expand their managerial empire. Furthermore, managers are inclined to engage in M&A activity because their compensation package is positively associated with firm growth. In 1999, Harford conducted a study to examine if cash-rich acquirers engage in M&A activity to a higher extent than less cash-rich acquirers. He found support for his hypothesis that cash-rich firms did partake in value-decreasing M&A. As managers have a higher level of liberty to use cash rather than equity or debt when financing investments (Harford, 1999).

$$Cash\ ratio = \frac{Cash + Cash\ Equivalents}{Current\ liabilities}$$

In 1981, Amihud and Lev studied M&A activity during the third wave and found that managers engage in conglomerate M&A strategies to diversify the business and reduce the risk of bankruptcy, more importantly reduce the risk of unemployment. They applied a regression model and found support of their hypothesis, managers during the third wave did engage in diversified M&A strategies as opposed to horizontal M&A to reduce unemployment risk (Amihud & Lev, 1981).

Misvaluation Theory

This thesis has selected MTB also known as price-to-book ratio as proxy to test for misvaluation. The MTB ratio is frequently applied in testing for misvaluation in prior literature. This project would have preferred to apply the methodological approach of (Rhodes-Korpf et al, 2005 & Shleiefer & Vishny, 2003). Their theory predicts that overvalued firm acquirer the relatively less overvalued firm, to test their hypothesis the MTB ratio of the acquirer and target is required. Hence, this project has employed an innovative methodology to test the misvaluation theory regarding M&A. The MTB-ratio formula is presented below:

$$MTB = \frac{Market\ value\ of\ equity}{Book\ value\ of\ equity}$$

To study misvaluation, this study has compared the logarithmic difference of the acquirer's MTB ratio. The argument is, if the market perceived the acquisition as successful the MTB of the acquirer would increase in the period following the M&A endeavours. To study this hypothesis, the latest MTB ratio prior to the announcement of the transaction was selected. Fu et al, (2011), conducted a similar study, but they applied the ROA-ratio to study the performance post-acquisition. Their empirical results suggest that acquisitions during overly optimistic markets significantly negatively affect the long run performance of the acquirer. Hence, their

results suggest the acquirer should avoid pursuing M&A with overvalued equity when markets are optimistically priced (Fu et al, 2011). Therefore, a 2-year post acquisition period was selected to measure the performance of the acquisition.

Efficiency theory

To empirically test for efficiency theory, the intangible asset ratio was the selected approach. This ratio is highly relevant for explaining M&A within the technology industry. The rationale for engaging in M&A is related to the opportunity to realise future growth ventures (Hall, 1987). Furthermore, to gains strategic assets, patents and IP (Blonigen & Tayler, 2000). Previous literature implies the motive for engaging in M&A is significantly higher when R&D expenditures of the acquirer are relatively lower than the competition. This externally driven strategy is considered of high importance in the technology industry since rapid innovation alter the business environment (Blonigen & Tayler, 2000). Firms with a 5 percent higher Capex towards R&D intensity experience a 26 percent lower yearly acquisition rate (Blonigen and Tayler, 2000). The intangible asset ratio of the acquirer is selected the quarter prior to the acquisition announcement. The formula is presented below:

$$Intangiable\ asset\ ratio = \frac{Intangiable\ asset}{Total\ assets}$$

Similarly, Danzon et al. 2007, conducted a study to concerning acquiring firms MTB ratio. Their findings suggest firms with low MTB ratios, which indicate conservative growth rates are more likely to engage in M&A endeavours to secure long-term growth opportunities (Danzon et al, 2007. However, since this project utilizes MTB ratio to test for misvaluation, the intangible asset ratio was the selected measure for efficiency theory.

Market Power Theory

The market power motive is regarded as highly important in relation to M&A and was a significant factor for explaining M&A activity in the three first waves in the U.S. The market power motive is highly relevant in the software industry as large firms acquire relatively smaller competitors to exploit their broad user-base and expand their network effects. Prior literature use industry concentration to examine the market power motive, the industry concentration is measured by the Herfindahl-Hirshman index (Andrade & Strafford, 2004). However, due to data unavailability regarding the total industry output this is not obtainable. The explanatory variable selected to access the market power motive is gross margin. High gross margins indicate whether firms have significant market power since customers cannot easily replace their existing supplier of goods (Bruner, 2004).

$$Gross\ Margin = \frac{Gross\ Profit}{Revenue}$$

The gross margin of the acquirer the quarter prior to the announcement date was selected, to examine the market power motive.

Industry Shock Theory

To examine external industry level shocks impact on M&A activity, researchers have found empirical evidence from serval variables. In 1996, Mitchell and Mulherin found evidence of shocks with the greatest magnitude originated from deregulation, chances in commodity costs and the emergence of technological innovation. They found sales growth and employment growth were significant explanatory factors for the aggressive takeover activity during the fourth M&A wave (Mitchell & Mulherin, 1996). Consistent with Mitchell and Mulherin results, Harford (2005) suggested industry shocks cause firms to engage in M&A activity to comply with the new business environment. The explanatory variables he employed to study industry shock theory were asset turnover, ROA, employee growth, Capex and R&D spending. This paper will incorporate ROA to examine for industry shock theory and the formula is presented below:

$$ROA = \frac{Net\ Income}{Assets}$$

The ROA of the acquirer will be incorporated the quarter before the announcement date. Furthermore, Harford's findings also indicate that economic shocks alone were not sufficient to accommodate a M&A wave without sufficient capital liquidity. Hence, macroeconomic factors such as interest rate was crucial for the propagation of a M&A wave to occur.

Economic Prosperity Theory

The economic prosperity theory revolves around the capital market condition and the economic outlook, these two conditions are vital for the emergence of an M&A wave (Melchier et al, 1983 & Harford, 2005). Consequently, proxies for these conditions were incorporated in this paper.

Capital Market Condition

The capital market condition is considered highly important in previous empirical studies, the literature review in section 2.2 clearly illustrates the importance of macroeconomic variables. Literature empirically examines this condition with interest rates determinates such as bond yields (Melchier et al, 1983). As a substantial part of M&A transactions are financed through corporate debt, the attractiveness of investments cash flows is

significantly affected by the cost of capital (Harford, 2005). Hence, favourable capital markets are crucial for M&A activity and the broad economy holistically. To proxy for the interest rates this paper incorporated the methodology from Melchier et all, 1983 and employed the U.S. 10-year treasury bond yield as an explanatory variable. In addition, the U.S. corporate spread was included to capture risk and liquidity in capital markets, the corporate spread measures the difference between U.S. government yield and the highest rated U.S corporate bonds (Choi & Jeon, 2011). In combination, the bond yield and corporate spread represents an appropriate proxy for testing the capital market hypothesis.

Economic outlook

To determine the impact of macroeconomic factors in the economic outlook theory towards M&A activity, the stock market proxied by S&P500 index was incorporated in this thesis. Elevated stock prices indicate high expectations for future economic growth (Shleifer & Vishny, 2003 & Gort. 1969). In addition to the stock market, GDP growth was also incorporated, which is positively correlated with financial markets. Hence, when corporations experience demand constrains, they acquire addition capacity externally through the M&A market (Harford, 2005). The empirical findings of previous academic literature highlight the importance incorporating macroeconomic factors to accurately examine the determinants of M&A activity. In sum, the S&P500 index and GDP growth represent a suitable proxy for the economic outlook.

The macroeconomic variables presented were all included in the study as lagged measures if they were significant, which follow previous academic studies. Deal volume was regressed against the macroeconomic variables employing 1, 2, 3, and 4 lags, the lag which provided the highest r-squared coefficient was included in this project. The neoclassic rationale for employing lagged macroeconomic measures is the managerial decisions for pursuing M&A is taken prior to the M&A announcement date and macroeconomic variables do not impact the underlying economy instantaneously (Choi & Jeon, 2011 & Melchier et al, 1983).

5.3 Data Transformation

An overview of the variables included in the study is presented in Table 6. In addition, the data transformation is presented for each variable included in the project.

Table 6: Variable Selection and Data Transformation Overview

	Variable	Acquirer/Target	Data Transformation
Hubris & Herding theory	2-year stock performance	Acquirer	Log
Agency Theory	Cash ratio	Acquirer	Real
Misvaluation Theory	2-year(MTB)	Acquirer	Log
Effifiency theory	Intangible asset ratio	Acquirer	Real
Market Power theory	Gross Margin	Acquirer	Real
Industry Shock Theory	ROA	Acquirer	Real
Economic Prosperity Theory	Bond yield	Acquirer	Real
	Corporate Spread		Real
	GDP		Real
	SP500		Real

Source: Own creation

Chapter 6

6.1 Econometric Methodology

This chapter presents the multiple regression assumptions and the econometric methodology applied to investigate whether micro- and macroeconomic variables impact M&A in the U.S. software industry.

6.1.1 Multiple Regression Assumptions

The multiple regression assumptions are presented in Appendix 1. Table 7 presents an overview of the regression assumptions.

Table 7: Multiple Regression Assumptions Overview

Assumptions	Test for examination
1) The relationship is linear in parameters between variables	plot of values and correlation matrix
2) Error Terms are normally distributed	Shapiro-Wilk & Jarque Bera
3) No serial correlation	Ljung-Box test
4) Homoskedasticity	Breusch-Pagan
5) No perfect multicollinearity	Correlation matrix
6) Random sampling of observations	Wald-Woldowitz Runs Test

Source: Own Creation

6.1.2 Model fit

This thesis compares the estimated models through Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). First, AIC is a measure frequently used in finance and economics to compare the goodness of fit of statistical models. The AIC measure is highly effective in identifying the model with the highest explanatory power for the data, while penalizing excessively complex models (Wooldridge, 2015). AIC estimates the relative amount of information lost: the highest quality model has the lowest Akaike score. The formula is presented below:

$$AIC = \log\left(\frac{1}{n}\sum_{i=1}^{N}\hat{u}^2\right) + \frac{2(k+1)}{N}$$

The Bayesian Information Criterion (BIC) is also a measure employed for comparing the goodness of fit for statistical models. However, it imposes a penalty for number of parameters to avoid overfitting. BIC is particularly useful when a large data sample is utilized (Wooldridge, 2015). The model with the lowest BIC is the preferred model. The formula is presented below:

$$BIC = \log\left(\frac{1}{n}\sum_{i=1}^{N} \hat{u}^2\right) + \frac{(k+1)}{N}\ logN$$

In sum, the model with the lowest BIC and AIC estimate is the preferred model.

6.1.3 Multiple linear Regression Model OLS

Multiple regression is a statistical method applied to examine if a relationship between the independent variables and dependent variable exists. As the research question implies, the data for this project is of micro- and macroeconomic nature. Previous studies (Melchier et al, 1983 & Choi & Jeon, 2011) applied times series model to conduct their studies. However, this is regarded inappropriate for this study, as this project require the inclusion of firm specific microeconomic variables to accurately examine the determinants of M&A activity. The exclusion of microeconomic factors would severely harm the validity of the findings generated from this thesis. (Gort, 1969 & Hayward et al, 1993) provided empirical evidence of the exclusion of microeconomic variables would diminish the overall validity. Therefore, a multiple linear regression model was selected to ensure a comprehensive study allowing for the inclusion of micro- and macroeconomic variables. Prior literature highly suggest that the coefficient of determination (R-squared) increases as micro- and macroeconomic factors are incorporated in the empirical study (Harford, 2005). Furthermore, the regression model is the preferred econometric model which table 2 in section 4.2 illustrate. The multiple regression model is presented below:

$$Y_{j,t} = \beta_0 + \beta_{j,1}x_{j,1} + \beta_{j,2}x_{j,2} + \beta_{j,m}x_{j,m} + u_{j,t}$$

In the formula $Y_{i,t}$ is the dependent variable, β_0 is the intercept, β_j is the partial regression coefficient, x_j is the explanatory variable and u_j represents the error terms (Wooldridge, 2015).

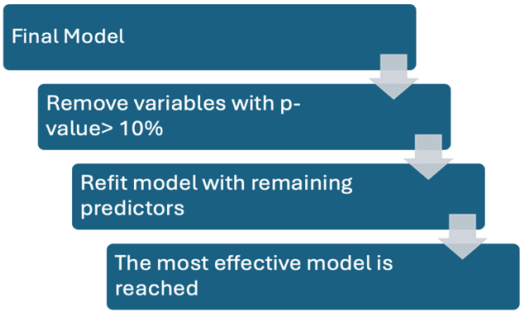
Employment of OLS Multiple Regression Analysis

The multiple regression technique selects the estimated regression line which are closest to the data points in the model. The coefficient of determination (R-squared) of the model measures the fraction of the dependent variable which is explained by the independent variables. Furthermore, coefficient of determination ranges

between 0 and 1, a r-squared coefficient of 0 indicates the variation of the dependent variable cannot be explained by the independent variables and new explanatory variables are required. In contract, a R-squared coefficient of 1 indicates the variation in the independent variable can be fully explained by the independent variables (Stock & Watson, 2015). Regarding internal validity of the regression model five sources cause the OLS estimator in regression models to be biased and inconsistent in measuring the casual effect of interest: omitted variable bias, misspecification of functional form, measurement errors, missing data and simultaneous causality bias (Stock & Watson, 2015). The omitted variable bias appears when the dependent variable is correlated with an omitted variable, said differently, when a statistical model excludes relevant explanatory variables, the omitted variable bias occurs. Second, misspecification of functional form occurs when employment of wrong form data in the regression, which can arise when failing to transform non-linear variables. Furthermore, the use of improperly pooled data and the omission of important variables in the regression model (Stock & Watson, 2015). Third, measurement errors arise when independent variables are determined incorrectly, which may cause bias in the OLS estimators. The sample selection for this thesis incorporated all the companies which fulfilled the criteria in section 5.1. Furthermore, the presentence of missing values leads to a smaller sample size which can cause biased results regarding measuring the population sample, undermining the reliability and validity of the model. Lastly, simultaneous causality relates to the potential problem of reversed causality where the dependent variable is responsible for changes in the dependent variable. In summary, these internal threats are a violation of the conditional mean of zero (Stock & Watson, 2015).

The first regression model presented is the model 1 where all the independent variables are included. The rationale for first including all the independent variables in the first model is to eliminate the omitted variable bias issue. Furthermore, there will also be presented a model containing the firm-specific microeconomic variables. However, if the variables are insignificant being below a p-value significance level of 10%, they will be removed from the model, following the methodology employed in prior literature within M&A. The backward elimination approach should ensure a valid regression model (Stock & Watson, 2015).

Figure 9: Backward Elimination Procedure



Source: Own Creation

Chapter 7

This chapter presents the results derived from the multiple regression analysis to examine the research question. Furthermore, this chapter presents the for multiple regression output and hypothesis testing for each on the variables in the thesis.

7.1 Multiple Regression Analysis

In the first model, all the variables derived from the neoclassic and behavioral theories were all included. Afterwards, the backward methodology approach was conducted meaning all variables with p-values> 10% were excluded. The second model contains only significant microeconomic variables to determinate if they have a significant relationship to deal volume.

Table 8: Multiple regression output for model 1

Variable	Model 1: Final Model
Intangible Asset Ratio	
2-year (P/B) ratio	
Gross Margin	
ROA	
Cash Ratio	
2- year stock performance	
GDP Lag 3	
SP500 return	
U.S. 10-year Treasury bill Lag 3	0.36 (0.063)*
Corporate spread Lag 3	
Intercept	1.56 (0.02)**
Multiple R-squared	0.076
DF	90
P-value	0.007
AIC	397.01
BIC	404.58

Coefficients are presented first

p-values are in parentheses

$p < 0.1^{*}, p < 0.05^{**}, p < 0.01^{***}$

Source: RStudio, Own creation

Assumptions

Before assessing the empirical findings of the model, multicollinearity needs to be examined. Derived from the correlation matrix, the highest correlation recorded in model 1 is among GDP lag 3 and corporate spread lag 3 with a negative correlation of -0.69. However, after applying the HAC-test corporate spread became

insignificant and therefore removed. Hence, multicollinearity was an issue in the model. Furthermore, the error terms were not normally distributed. Therefore, the test is an approximated test.

Results

This section discusses the results of Table 8. Initially the only significant microeconomic variable was ROA with a p-value of 0.059. But it was removed due to insignificance after refitting the model with only significant variables. However, the remaining microeconomic variables displayed no significant explanatory power towards deal volume and was therefore removed from the model. The intercept being positive and statistically significant indicates when treasury bills is 0, deal volume has an expected value of 1.56. Moreover, the macroeconomic variables included in the model exhibited the highest degree of explanatory power towards deal volume. Specifically, corporate spread lag 3 and treasury bill lag 3 exhibited, unexpectedly, significant positive influence towards deal volume indicating they have explanatory power towards deal volume. Furthermore, GDP lag 3 also had a significant impact towards deal volume at a 10% significance level, which prior literature also have found (Melchier et al, 1983). However, the variance was not constant and therefore the HAC test was performed where GDP lag 3 and corporate spread lag 3 became insignificant. Here, the results derived from corporate spread were contradicting the existing literature, as they found a significant negative relationship between the corporate spread and M&A activity (Melchier et al, 1983). Moreover, interest rates proxied by U.S. 10-year treasury bill was the only significant variable after refitting the model. The findings of interest rates being a significant determinant of M&A activity was in support of former empirical studies of (Melchier et al, 1983 & Harford, 2005). However, it was anticipated interest rates and deal volume would be inversely correlated and not exhibit a positive relationship, which they do in the model presented. In the model, a 1% increase in treasury bills is followed by 0.36% increase in deal volume. Furthermore, according to the final model, the stock market proxy by SP&500 did not exhibit explanatory power towards deal volume which is contradicting the empirical findings of research conducted by Melchier and colleagues (Melchier et al, 1983).

Model fit

Regarding the model fit, the goodness-of-fit test revealed a R-squared coefficient of 0.076, which indicates that the model has a weak influence towards explaining deal volume. The model explained approximately 7.6% of the variation in deal volume, which is not a desirable R-squared coefficient for a model containing micro- and macroeconomic variables. Before applying the HAC-test, the model explained 13.5% of the variation in the dependent variable. However, the p-value of 0.007 highly indicate that a significant relationship is existing between the independent variables and deal volume. Moreover, the R-squared in Choi & Jeon (2011) macroeconomic model explained approximately 19% of the variation in deal volume.

Table 9: Multiple regression output for model 2

Variable	Model 2
Intangible Asset Ratio	-2.63 (0.0285)**
2-year (P/B) ratio	
Gross Margin	
ROA	
Cash Ratio	
2-year stock performance	-0.8 (0.064)*
Intercept	3.97 (0.000)***
Multiple R-squared	0.08
DF	89
P-value	0.022**
AIC	398.53
BIC	408.62

Coefficients are presented first

p-values are in parentheses

$p < 0.1^{*}, p < 0.05^{**}, p < 0.01^{***}$

Source: RStudio, Own creation

Assumptions

Multicollinearity was not regarded problematic among the independent variables. In model 2, the error terms were not normally distributed, indicating the tests are approximated tests.

Results

Regarding the results of model 2, this model incorporates all the microeconomic variables to examine if they exhibit significant explanatory power towards deal volume, thereby excluding the macroeconomic variables. Furthermore, the intangible asset ratio of the acquirer displayed a significant negative relationship towards deal value with a coefficient of -2.63. The p-value is highly significant at the 10% level, indicating that a 1 unit increase in intangible asset ratio is associated with 2.63% lower deal volume. These findings are in support of the empirical results of Blonigen & Tayler (2000). Their findings indicate that a low R&D intensity provides an incentive for the acquirer to externally acquire strategic assets through M&A. Additionally, the 2-year stock performance of the acquirer following an acquisition also revealed a significant negative relationship. These findings are in line with previous empirical results (Hayward & Hambrick, 1997). The intercept of model 2 was also significant, meaning when the predictors are zero, the independent variable has an expected value of 3.97. Lastly, 8% of the variation in the dependent variable is explained by the independent microeconomic variables in model 2.

Model fit

The goodness-of-fit reveals a R-squared coefficient of 0.08 which indicates that the model exhibits a weak influence towards deal volume. Here, the model explained 8% of the variation in deal volume. However, the p-value of 0.022 highly indicates that a significant relationship is existing between the independent variables and deal volume.

7.1.1 Model Selection

To assess the model fit, the R-squared coefficient of model 1 accounts for 7% of the variation in deal volume. In contrast, the R-squared coefficient of model 2 explains 8% of the variation in deal volume. However, using the R-squared coefficient to compare models must be avoided (Wooldridge, 2015). Therefore, this project will compare the models through Akaike information criterion (AIC) and Bayesian information criterion (BIC). The most efficient model according to AIC and BIC is model 1, therefore, model 1 is the preferred model containing the highest explanatory power regarding the data.

7.1.2 Behavioral Theory Hypothesis Testing

This section presents the empirical findings following the regression results regarding the behavioral theories presented in section. 3.1. Furthermore, this section will provide the hypothesis for each of the corresponding neoclassic and behavioral economics theories. The hypothesis will either be rejected or accepted based on the empirical findings.

Managerial Hubris Theory and Herding Theory

To examine hubris and herding theory, the following hypothesis was developed:

H_1: *Overconfident managers engage in value-destroying M&A*

This hypothesis was tested through the acquirer's 2-year stock performance and thereby measuring the 2-year percentage change. Model 2, containing microeconomic variables exclusively, established support for H_1. The stock performance had a negative impact on deal volume with a negative coefficient of -0.8 and thereby indicating that a 1 unit increase in 2-year stock performance is associated with a 0.8% lower deal volume. Therefore, the findings supported the hubris and herding theories.

Agency Theory

To test for agency theory, the following was hypothesized:

H_2: *Firms with high cash ratios positively affect deal volume*

This was tested through the explanatory variable cash ratio. However, as presented in the model 1 and 2, the cash ratio was insignificant and therefore removed from the model 1. Furthermore, the variable was also regressed alone against deal value and the p-value was insignificant. Hence, this project did not support agency theory being a significant motive for pursuing M&A.

Misvaluation Theory

This project employed MTB ratio to assess the misvaluation theory, the following hypothesis was tested:

H_3: *Firms MTB ratio would decrease following an acquisition*

This hypothesis was tested through the 2-year percentage change of the acquirer's MTB ratio. The rationale for selecting this methodology was that the MTB ratio of the acquirers would decrease due to high premiums paid. However, as evident in model 1 and 2, the variable showed insignificant p-values and was therefore removed for the models. The MTB ratio was also regressed against deal volume and the p-value was insignificant. Therefore, the findings did not find support H_3 being a significant motive for pursuing M&A.

7.1.3 Neoclassic Theory Hypothesis Testing

This section presents the empirical findings and an interpretation of the regression results regarding the neoclassic economic theories presented in section 3.1.

Efficiency Theory

To examine efficiency theory, the following hypothesis was tested:

H_4: *M&A activity is inversely related to high intangible asset ratios*

To empirically access the hypothesis, the intangible asset ratio was employed. In the first model, the intangible asset ratio was statistically insignificant and therefore removed. However, as evident in model 2 containing microeconomic variables exclusively, the ratio was highly significant with a p-value of 0.03 and with a negative coefficient of -2.76. In other words, a 1 unit increase in intangible asset ratio is associated with -2.7%

lower deal volume. Hence, the intangible asset ratio is negatively related to deal volume. These findings are in line with previous empirical results, as a 5% higher R&D intensively relates to a 26% lower acquisition rate (Blonigen and Tayler, 2000). Therefore, these findings support efficiency theory as a motive for pursuing M&A.

Market Power Theory

To empirically test for market power theory, the following hypothesis was developed:

H_5 : *M&A activity is positively associated with the market power motive*

To test the market power motive, this project applied gross margin. As evident in the model 1 and 2, the variable was insignificant and therefore removed. Additionally, the variable was regressed against deal volume and generated a p-value of 0,72. Hence, this project did not find support of the market power theory as a significant motive for pursuing M&A.

Industry Shock Theory

To examine for industry shock theory, the following hypothesis was tested:

H_6: *Industry shocks are vital determinants for M&A activity*

To empirically test for the industry shock theory, this project followed previous literature's methodology and applied the ROA ratio. However, as evident in model 1 and 2, ROA was insignificant and therefore removed. Therefore, this thesis did not find support of industry shock as a significant motive for pursuing M&A.

Economic Prosperity Theory

To test for the economic prosperity theory, two hypotheses were developed:

H_7: *M&A activity is inversely correlated with bond yields and the corporate spread*
H_8: *M&A activity is positively related to the economic outlook*

To test for H_7, the 10-year treasury bill and corporate spread with the most significant lags were incorporated in this thesis. Firstly, both variables were significant with p-values below the 1% significance level. However, unexpectedly, both variables were positively associated to deal volume. In terms of bond yields, 1% increase in bond yields is associated with a 0.53% increase in deal volume. Furthermore, 1% increase in the corporate

spread is followed by an 1% increase in deal volume. These results are highly surprising as it was expected that cost of capital would be inversely correlated to deal volume as prior literature within M&A suggest. However, after performing the HAC-correction corporate spread became insignificant and therefore removed from the model.

H_8 was tested through GDP lag 3 and SP&500 lag 1, 2, 3 and 4. SP&500 was insignificant for all the relevant lags and was therefore removed from model 1. However, GDP lag 3 was significant for model 1 with a positive coefficient of 0.2, suggesting a 1% increase in GDP is positively associated with a 0.21% increase in deal volume. The findings of GDP as a significant determinant of M&A activity are in line with the empirical findings of both (Gort, 1969 & Melchier et al, 1983). After the HAC-correction, GDP lag 3 became insignificant and therefore removed from model 1. Furthermore, SP&500 return was not significant in any of the models presented and when it was regressed alone against deal volume the p-value was 0.7 and therefore highly insignificant.

7.2 Summary

The hypothesis findings presented in section for 8.2.1 and 8.2.2 are summarized in table 11

Table 10: Findings from hypothesis testing

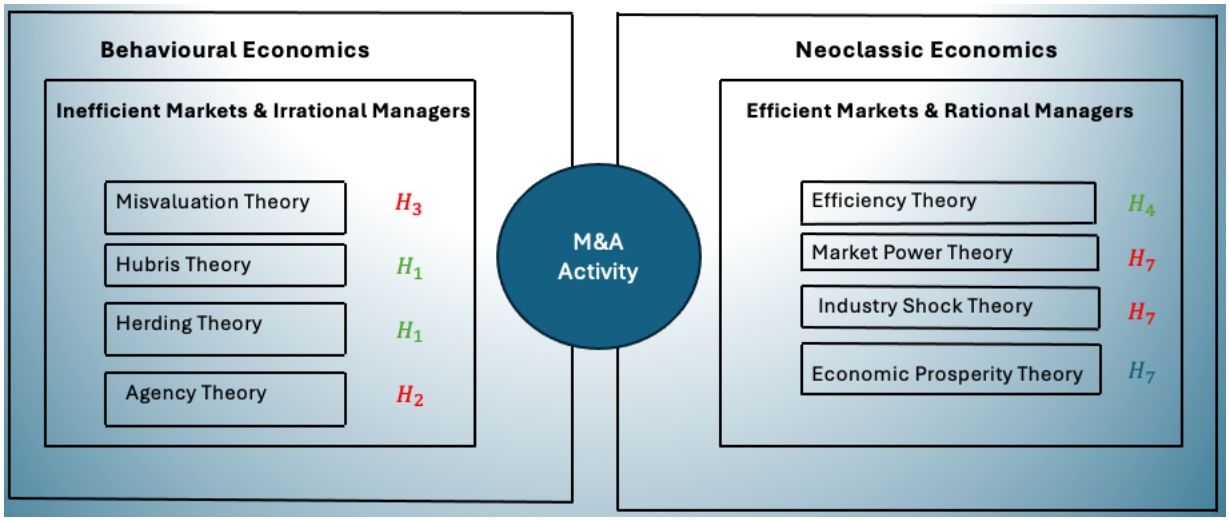
Theory		Variable	Coefficient	Conclusion
Hypothesis 1	Hubris & Herding theory	2-year stock performan	(-)	Support
Hypothesis 2	Agency theory	Cash ratio	(-)	No support
Hypothesis 3	Misvaluation theory	MTB ratio	(-)	No support
Hypothesis 4	Efficiency theory	Intangiable asset ratio	(-)	Support
Hypothesis 5	Market Power theory	Gross margin	(+)	No support
Hypothesis 6	Industry Shock theory	ROA	(+)	No support
Hypothesis 7	Economic Prosperity Theory	GDP	(+)	No support
		SP500 return	(-)	No Support
		Bond Yield	(+)	partly support
		Corporate spread	(+)	No support

(-) negative coefficient, (+) positive coefficient

Source: Own Creation

In summary, the inclusion of neoclassic and behavioral variables is significant for studying M&A activity within the U.S. software industry as evident in table 10. However, the neoclassic variables of micro- and macroeconomic origin exhibited the highest explanatory power regarding U.S. M&A activity. Especially, treasury bills derived from the economic prosperity theory were most significant in explaining M&A activity in the U.S. software industry.

Figure 10: Visual presentation of hypothesis results



Green support, red no support, blue partly support

Source: Own Creation

Chapter 8

8.1 Discussion

This section discusses the empirical findings from the literature review presented in section 4.1. and the regression results sections 7.1. By comparing the empirical findings presented in the literature review to the regression results.

8.1.1 Behavioral Economics

This section discusses the empirical results regarding managerial hubris, herding, agency and misvaluation theory, which are the foundation for examining the behavioral economics paradigm.

Managerial Hubris & Herding Theory

Hubris and herding theory are two related theories, which contribute a significant behavioral perspective for explaining M&A activity. The underlying assumption in hubris is overconfident managers partake in value-destroying M&A deals, where they overestimate the expected synergies (Hayward et al, 1997). Herding is where acquirers ignore rationality and pursue M&A deals because of other firms doing so, often when markets are priced excessively high (Roll, 1986).

The hubris theory argues that overconfidence of management leads to a negative stock performance. Hayward & Hambrick (1997), conducted a study to examine whether acquisitions negatively affected the underlying share price. They found that the acquirers experienced a significant negative 1-year return following their M&A endeavour. Their results imply that CEO self-confidence and recent stock performance of the acquirer is highly associated with the premium paid for the acquisition (Hayward & Hambrick, 1997). In contrast, another study found CEO overconfidence benefits shareholders as they invest more in R&D and generally obtains more patents than risk-adverse managers. However, this is only achieved in innovative industries such as in technology (Hirshleifer et al, 2012).

Herding theory, Bouwmann, Fuller and Nain (2009) conducted a study to examine whether acquisitions during optimistic markets underperformed acquisitions in low-valuating markets. Their findings are consistent with the herding theory as acquisitions during high-valuation markets significantly underperformed acquisitions in low valuation markets. Another study found similar results, they found strong economy deals were value-destroying compared to deals in low-valuation which generated 9% higher returns (Kengelbach et al, 2017).

In summary, the hubris and herding hypothesis were verified in model 2. The findings were anticipated as the sample of this project is heavily skewed towards the dot.com wave where valuations were excessively high. Therefore, overconfidence and irrationality displayed explanatory power towards M&A activity in the U.S. software industry.

Agency Theory

Another highly relevant theory from the behavioral paradigm is agency theory, which predicts misalignment between shareholders and management is prone to happen as managers maximize their own utility (Jensen & Meckling, 1976). First, a study was conducted to examine whether cash-rich firms pursued a M&A conglomerate strategy to derisk the entity by diversifying income streams to avoid bankruptcy and unemployment. Their hypothesis was confirmed, managers pursued a conglomerate strategy for personal motives such as to expand the managerial empire and reduce unemployment risk rather than maximizing shareholders returns (Amihud & Lev, 1981). Second, a study was conducted to examine whether cash-rich acquirers engaged in M&A activity to a higher extent that less cash-rich acquirers. The hypothesis was confirmed as managers have higher liberty of cash than debt and equity financing (Harford, 1999; Bruner, 2004).

In summary, the cash ratio displayed insignificant explanatory power towards M&A activity within the U.S. software industry for the period of this study. These findings are contradicting to the empirical results of Bruner, 2004; Harford, 1999) which emphasises that industry focus and period of investigation are intercorrelated with the results.

Misvaluation Theory

The misvaluation theory provides a different perspective than agency, herding and hubris. Here, managers are rational and the acquirer's management exploit market inefficiencies to maximize shareholder value (Shleifer et al, 2003 & Rhodes-Kropf et al, (2005). A study was performed to assess the hypothesis of overvalued firms acquire less overvalued firms, using MTB as valuation metric. Their findings suggest, targets are more likely to overvalue the offer, the greater the overall overvaluation of the market becomes even when the target's equity is impacted by the same overvaluation to a relatively lesser extent (Rhodes-Kropf & Viswanathan, 2005). Furthermore, they also found that cash acquirers generally are less overvalued than stock acquirers (Rhodes-Kropf & Viswanathan, 2005). In support of existing theory, a study found that when markets are depressed cash is the primary finance source and when markets are highly valued stock is the primary finance source equity (Fu et al, 2011). Furthermore, they also found that overpaying for the target with overvalued equity significantly affect the long-term performance of the acquirer negatively, which is supporting prior

results (Fu et al, 2011). An innovative study challenging the neoclassic perspective was performed, arguing that private firm's part in the M&A wave would decrease as markets became increasingly overvalued as they cannot utilize equity as payment since they are private. Their hypothesis was confirmed, private firms' participation in the M&A wave drastically decreased as markets surged (Gugler et at, 2012). This behavioral was anticipated from a behavioral standpoint, but inconsistent with neoclassic economics. Furthermore, they found that overvalued acquirer's perform larger deals of monetary value, but a lower number of deals. (Gugler et al, 2012).

This thesis utilized a different approach than employing the targets and acquirer's MTB ratio due to data unavailability. The rationale for employing the 2-year change in MTB ratio of the acquirer is because substantial evidence indicates the acquirer's stock performance is negatively affected post-acquisition, therefore investors sell the underlying asset. However, this hypothesis was rejected based on the regression results. Nonetheless, literature unanimously suggest microeconomic factors do exhibit explanatory power towards deal volume.

8.1.2 Neoclassic Economics

This section discusses the empirical results regarding managerial efficiency, market power, industry shock and economic prosperity theory, which are the foundation for examining the neoclassic economics paradigm.

Efficiency Theory

Synergies are frequently used as an explanation for why one merged entity is worth more than two separate entities. Managers are using the synergy argument to rationalise paying a significant premium for their M&A endeavours. Here, three types of synergies are widely accepted in neoclassic theory: financial, managerial and operating synergies. The three types are associated with either cost reduction or revenue enhancement, which ensures value maximizing for firms (Trautwein, 1990).

Empirical evidence highly indicates a positive association between firm size and operational synergies, as firm size is correlated with economics of scale (Gorton et al, (2009). Moreover, in the software industry a broad user base is considered pivotal to realise network effects. Here, the arms race for firm size often leads to profitable acquisitions and their theory contribute to explaining why M&A waves are concentrated in industries in which a regime shift can be identified (Gorton et al, 2009). In contrast, substantial evidence emphasises that 80% of M&As lead to devastated shareholders (Kengelbach et al, 2017 & Bruner, 2004). Furthermore, their

empirical findings also indicate firms acquire relatively smaller firms as a defensive strategy to reduce the likelihood of being acquired (Gorton et al, 2009).

Second, evidence from the electronic industry argues a low intangible asset ratio was expected to be a significant motive for pursuing M&A. Literature indicate the motive for engaging in M&A is stronger when R&D expenditures of the acquirer are relatively lower than the competition. Hence, low R&D intensity provides an incentive to externally acquire crucial intangible assets to enhance efficiency through synergistic gains. The externally driven strategy is considered of high importance in the technology industry since rapid innovation alter the business environment (Blonigen & Tayler, 2000). The technology giants Facebook, Salesforce, Google and Microsoft have acquired serval competitors in their corporate history to exploit their networks effects and integrate them into their ecosystem. Firms with a 5 percent higher Capex towards R&D intensity experience a 26 percent lower yearly acquisition rate on average (Blonigen and Tayler, 2000). The hypothesis of M&A being inversely correlated to the intangible asset ratio was accepted. This thesis found evidence of a 1 unit increase in the intangible asset ratio is negatively associated with 2.7% lower deal volume.

In summary, the theoretical stance towards efficiency theory indicates the microeconomic factor intangible asset ratio of the acquirer is significant for explaining M&A activity within the U.S. software industry.

Market Power Theory

In the neoclassic economics paradigm, market power theory argues, the opportunity to enhance market power and revenue is a significant motive to perform M&A activities (Gugler et al, 2013). A study found that mergers on average result in significant increase in profits but reduced the overall sales of the combined entity. Theoretically, a positive association was found as mergers decrease the industry concentration, meanwhile the acquiring firm increase in size, which positively impacts FCF and may reduce the combined firm's overall cost of capital (Gugler et al, 2013). Furthermore, enhanced market power expands the barging power towards customers and supplies, which can impact gross margins positively. In the software industry, the market power motive is considered a significant motive for performing horizontal M&A to expand market power. However, no evidence was found to support the market power motive for this thesis.

Industry Shock Theory

In neoclassic economics, a widely accepted explanation for why M&A activity is clustering at the industry level is the industry shock theory. Here, firms operating environment is affected by shocks occurring at the industry level, which causes an asset reallocation and altering the attractiveness of industries (Gort, 1969). A study examining the 1980's takeover wave found deregulation, changes in input cost and rapid innovation in financing induced alteration in certain industry structures (Mitchell & Mulherin, 1996). Their empirical

findings clearly illustrate the importance of incorporating industry-level factors to ensure an extensive empirical analysis. They employed sales growth and employment growth as proxies for industry performance and found that both factors had significant positive explanatory power in relation to takeover activity (Mitchell & Mulherin, 1996). Due to data availability, this project employed ROA and found an insignificant positive association between deal volume and ROA.

An extension of the industry shock theory was developed by Harford (2005), he found that industry shocks exclusively are not sufficient to accommodate an asset reallocation, but overall liquidity is the determining factor for a wave to occur (Harford, 2005).

The importance of including variables representing industry shocks presented by Mitchell and Mulherin (1996), are vital to examine M&A activity. As evident, ROA was positively associated with M&A activity but according to the regression model, the findings were not significant. Hence, literature unanimously agree that shocks at the industry level alter the attractiveness of industries, which imply the importance of microeconomic factors when studying M&A activity.

Economic Prosperity Theory

The economic prosperity theory provides the theoretical foundation to examine the relationship between macroeconomic factors and M&A activity. The theory is composed of the capital market condition and economic outlook. In academic literature the economic outlook is considered a pivotal prognosticator of M&A activity. The empirical findings discovered a significant positive association between GDP and deal volume, however after applying the HAC-correction the relationship is positive but becomes insignificant. The findings of GDP and deal volume being positively correlated was in consensus with prior literature (Choi and Jeon, 2011). The S&P500 index is perceived as a significant predictor of future economic growth, it was highly anticipated a positive relationship between S&P500 and deal volume was established as in prior literature (Choi et al, 2011 & Melchier et al., 1983). However, according to the model, S&P500 index and deal volume were insignificant negatively correlated. Here, multicollinearity could be the reason but according to the correlation matrix none of the variables were significantly positive or negative correlated, meaning a correlation above 0.8. Another possible explanation is model misspecification, at indicated by the reset test the model is misspecified. This could provide a possible explanation for the regression results.

The capital market condition is also considered a vital macroeconomic prognosticator of M&A activity. This study surprisingly revealed that deal volume and bond yields are significant negatively correlated. The findings of a negative relationship was unexpected, as neoclassic economics paradigm argues that lower cost of capital results in higher NPV from investments. Furthermore, M&A transactions are frequently financed through

corporate debt, therefore an inverse correlation between interest rates and deal volume would be expected (Melchier et al, 1983 & Harford, 2005). However, an environment of high interest rates is often accompanied by a strong underlying economy. Therefore, the overall confidence in the overall economy might lead to higher deal volume despite elevated borrowing costs. Another explanation could be the majority of M&A deals are financed through equity which are less sensitive to elevated interest rates. In this thesis, the sample is skewed towards the dot.com bubble where equity was the primary source of financing, in 1990 the percentage of stock acquisitions were 24% and in 1998 the acquisition payment of stock peaked at 68% (Rhodes-Kropf & Viswanathan, 2005). The study also revealed a positive insignificant relationship between corporate spread and deal volume. In contrast, the corporate spread was anticipated to be negatively correlated to deal volume. As a wide corporate spread indicates a higher perceived risk in the underlying economy (Choi & Jeon, 2011). However, as a wide corporate spread indicate greater perceived risks, companies may pursue M&A to exploit market opportunities. As literature suggests, engaging in M&A when markets are uncertain generate substantially higher returns compared to pursing M&A deals when markets are valued to perfection (Kengelbach et al., 2017). Lastly, wider corporate spreads indicate uncertain financial markets where firms perform restructuring activities which may lead to a surge in deal volume for technology firms.

In summary, the empirical findings derived from the economic prosperity theory were significantly different from prior studies within M&A, which emphasis the empirical findings are intercorrelated with industry focus and period of investigation. However, it is evident that macroeconomic factors are crucial for explaining M&A activity within the U.S. software industry.

8.2 Summary

In conclusion, the theoretical discussion indicates that both microeconomic and macroeconomic variables are relevant in explaining M&A activity within the U.S. software industry. As evident in table 10, the neoclassic variables were slightly more relevant in explaining M&A activity than the behavioral paradigm variables. Comparing the empirical findings of this examination to the previous literature, the discoveries from this thesis were highly inconsistent with prior literature. This clearly indicates that the results are highly intercorrelated with industry focus and time period.

Chapter 9

9.1 Limitations

This chapter presents the limitations of the empirical findings of the thesis which pose restrictions to the internal and external validity of the findings.

First, the empirical findings are representative only for the U.S. software industry and therefore the results cannot be generalized to unrelated industries or cross-border M&A markets. Also, the macroeconomic variables are limited to being representative for the U.S software industry. Hence, the industry and geographical focus is vital to ensure a comprehensive and reliable study. Furthermore, the goodness-of-fit test revealed additional micro- and macroeconomic variables excluded from the models are relevant for explaining M&A activity, and thereby affecting the decision to pursue M&A.

Another limitation is that the empirical findings derived from the regression models need to be interpretated with caution as OLS assumptions were violated in the two models. Hence, violation of the OLS assumptions severely reduces the validity of the regression results and may affect the analysis to become inconsistent with the reality.

To examine M&A activity, deal volume was applied as proxy. The sample size was too narrow to be aggregated into monthly observations. A sample size containing only four yearly observations naturally constitutes a limitation as opposed to 12 monthly observations. Furthermore, the sample is heavily skewed towards the dot.com wave as 29.5% of the observations stems from that wave. This causes a sample bias towards the 5th wave. Also, the small sample size undermines the internal and external validity of the study, especially the wave after the financial crisis contained relatively few M&A transactions. Therefore, an alternative approach could be to divide the sample into subsamples representing the three waves to assess whether the waves were impacted by the same underlying micro- and macroeconomic factors.

Chapter 10

10.1 Conclusion

The objective of this thesis is to empirically examine the underlying determinants of M&A activity within the U.S. software industry. As previous literature highly suggests, a comprehensive study of the drivers of M&A activity which the includes both micro- and macroeconomic variables is vital to ensure a reliable and robust model.

An exhaustive literature review was necessary to provide the theoretical foundation for an examination of M&A activity within the U.S. software industry. Here, prior empirical studies highlighted the importance of including behavioral and neoclassic variables as they are regarded highly relevant for explaining M&A behaviour. However, as evident in section 4.1, most of empirical studies employ either a behavioral or neoclassic methodology for studying M&A activity. Here, the U.S. software industry has been the selected industry focus as it is less extensively studied than long-established industries. Thus, the aim of this thesis is to contribute with new empirical findings. Furthermore, the software industry has been increasingly more relevant since its emergence and the largest companies by market capitalization are software-related companies. Therefore, this thesis found it highly interesting to examine the underlying factors impacting M&A activity within the U.S. software industry. As a result, the data consists of 290 observations aggregated into quarterly observation from 1994-2019 and to study M&A activity deal volume has been applied as a proxy.

To investigate the underlying drivers of M&A activity, the multiple linear regression model was the employed methodical research approach, which allows for the inclusion of micro- and macroeconomic variables. The multiple linear regression approach is also commonly employed among researchers within M&A activity. As mentioned, the observations were aggregated into quarterly observations instead of higher frequency data to ensure stable and reliable regression coefficients and thereby avoid short-term volatility present in higher frequency data.

The behavioral economics paradigm was assessed through four theories: hubris, herding, agency and misvaluation theory. Here, irrationality of managers is assessed through hubris, herding and agency theory and the inefficient market theory is associated to misvaluation theory. First, hubris and herding were jointly tested for, and the findings supported the hypothesis that managers did engage in value-destroying M&A. Second, the empirical findings of agency theory rejected the hypothesis that firms with high cash ratios positively affect deal volume. Lastly, the empirical findings did not find support of misvaluation being a significant motive for

pursuing M&A. Overall, the microeconomic factors representing the behavioral theories displayed conflicting results regarding explaining M&A activity within the U.S. software industry.

The neoclassic economics paradigm was evaluated based on four theories: efficiency, market power, industry shock and economic prosperity theory. First, the efficiency theory hypothesis of M&A activity being inversely correlated with intangible asset ratio was supported by the empirical findings. Second, the neoclassic economics paradigm argues that the market power theory is positively associated with M&A. However, the findings of this thesis did not support this hypothesis. Third, the theory of industry shocks argues that industry shocks alter the industry structure and thereby cause an asset reallocation to capture the new business environment. However, this was not support by the empirical findings. Fourth, the findings of the economic prosperity were partly supported. Here, the findings revealed that GDP had an insignificant positive impact towards M&A activity within the U.S. software industry. However, no evidence was found of S&P500 impacting M&A activity. In contrast, it was anticipated bond yields and corporate spread were inversely correlated with M&A activity. However, the empirical findings indicate bond yields and corporate spread were positively correlated with M&A activity. To sum up, Table 11 below presents an overview of the findings of the thesis relating to the listed hypothesis.

Table 11: Conclusion on the Hypothesis

Hypothesis	Theory	Conclusion
Hypothesis 1	Hubris & Herding Theory	Support
Hypothesis 2	Agency Theory	Reject
Hypothesis 3	Misvaluation Theory	Reject
Hypothesis 4	Efficiency Theory	Support
Hypothesis 5	Market Power Theory	Reject
Hypothesis 6	Industry Shock Theory	Reject
Hypothesis 7	Economic Prosperity Theory	Partly support

Source: Own Creation

Overall, the empirical findings suggest the neoclassic micro- and macroeconomic variables were slightly more effective in explaining M&A activity within the U.S. software industry than the behavioral variables. The results clearly demonstrate that variable selection, time period and industry focus are highly relevant when rejecting or approving theories forming the theoretical framework.

To answer the research question, the empirical investigation determinates micro- and macroeconomic factors impact M&A within the software industry from 1994 to 2019. However, additional variables are required to accurately describe the variation in deal volume.

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Appendix 1: Multiple Regression Assumptions

1) **The Relationship is linear in Parameters**

When a regression model is considered linear in parameters the dependent variable Y_i, is a linear function of the independent variables x_j, and the error term ε_j. In other words, when the value of the independent variables' changes, the depended variable must also change (Stock & Watson, 2015). The assessment of the linearity assumption will be examined through a plot and the correlation matrix.

2) **Error Terms are Normally Distributed**

When testing for normality of the error terms, the Jarque-Bera test is frequently applied. It conducts the test using the residuals as their approximation. The hypothesis is presented below:

$$H_0 = Skweness\ and\ kurtosis\ match\ a\ normal\ distribution$$
$$H_1 = Skewness\ and\ kutrosis\ do\ not\ match\ a\ normal\ distribution$$

Rejecting the null hypothesis, indicates the data does not support normally distributed error terms. Therefore, the tests are approximated tests (Wooldridge, 2015). The formula is presented below:

$$JB = \frac{N}{6}(S^2 + 0.25(k-3)^2)$$

Where S is skewness, K is Kurtosis and N is number of observations.

3) **Homoscedasticity**

When the error terms in a regression model exhibit constant variance across all levels of the independent variable, homoscedasticity is present in the model (Stock & Watson, 2015). The error term in a regression model is considered homoscedastic, when the variance of error term is ε_j, is equal for the all the independent variables x_j, included in the sample. Furthermore, heteroscedasticity occurs when the conditional variance of the error term ε_j, is depended on the independent variables x_j, then the error term is considered heteroskedastic. Formula for Homoscedasticity is presented below (Wooldridge, 2015):

$$Var(\varepsilon_j|X_1, X_2, ..) = \sigma^2$$

The standard errors of regression coefficients are biased when the variance of the error terms is not constant. Furthermore, the presence of heteroscedasticity negatively impacts the hypothesis testing as the estimates are

unreliable. The R-squared coefficient in a regression model assumes homoscedasticity, therefore the R-squared can be inefficient in the presence of heteroscedasticity. This thesis examines homoscedasticity through the Breusch-Pagan (BP) test because of BP if the preferred method when many regressors are present in the model (Wooldridge, 2015). The null and alternative hypothesis is presented below:

$$H_o = Homoscedascity\ is\ present$$
$$H_1 = Hetroscedascity\ is\ present$$

As visualized above accepting the null hypothesis indicates homoscedasticity. In contrast, rejecting the null hypothesis indicate the error terms variance is not constant and therefore, the regression results are unreliable. However, in financial data heteroscedastic error terms are very likely. Therefore, in the presence of heteroscedasticity, a test called heteroscedasticity-and-autocorrelation-consistent standard errors (HAC) will be employed to perform hypothesis testing (Wooldridge, 2015).

4) **No serial autocorrelation**

Autocorrelation occurs when the residuals in a regression model are correlated across different observations. An important assumption in linear regression models is, that the residuals are independent and identically distributed, autocorrelation is frequently problematic for times series data (Wooldridge, 2015). Furthermore, if autocorrelation is present estimates from t-tests and f-tests become unreliable. The R-square coefficient can also be misleading in the presence of autocorrelation, indicating the model fit is better than it is. To examine for autocorrelation in the error terms, this project employs Ljung-box test. The formula is presented below:

$$Corr(\varepsilon_j|\ \varepsilon_{i-1}) = 0$$

In the formula presented, the error term does not depend on its previous lagged value and thereby behave as white noise, which is highly important assumption regarding regression models. Furthermore, autocorrelation causes the OLS estimators to be inefficient and unreliable. Here, it also negatively affects the reliability of the R-squared coefficient, suggesting the model fit is better than it is (Wooldridge, 2015). The hypothesis is presented below:

$$H_o = The\ residuals\ are\ independently\ distributed$$
$$H_1 = The\ residuals\ aexhibit\ serial\ correlation$$

Testing the autocorrelation assumption, failing to reject the null hypothesis indicates the residuals are independently distributed. In contract, rejecting the null hypothesis indicate serial correlation in the error term.

5) **No perfect multicollinearity**

Multicollinearity can occur between independent variables in regression models, especially between macroeconomic variables as they are impacted by the same underlying changes in the economy. Perfect multicollinearity occurs when the independent variables are perfectly correlated which is a violation of no perfect multicollinearity assumption in linear regression. Here, correlation coefficients close to +0.9 and -0.9, highly indicate multicollinearity. High levels of multicollinearity lead to difficulties in determining the individual effects between the independent variables and the response variable. Furthermore, multicollinearity inflates the standard errors of regression coefficients, this reduces the statistical power by enlarging confidence intervals and making it harder to obtain significant relationships between independent variables and the dependent variable. Here, multicollinearity also causes regression coefficient to become highly sensitive towards small changes in the model, causing unreliable estimates and severely harming the validity of the regression (Wooldridge, 2015). The no perfect multicollinearity assumption will be studied through a correlation matrix. Correlation above -0.8 and 0.8 is regarded problematic for the predictive quality of the model, and if variables have correlations above that threshold, they will be excluded from the model.

6) **Random Sampling of Observations**

The random sampling criteria states, the data must be randomly selected form the population which ensures the data is independently distributed. The Wald-Woldowitz Runs test for randomness will be applied to assess whether the data is random. The formula is presented, and hypothesis are presented below:

$$X = \frac{r - \mu_r}{\sigma^r}$$

Where r is the number of runs, μ_r is the expected number of runs and σ^r is the standard deviation of the number of runs (Stock & Watson, 2015).

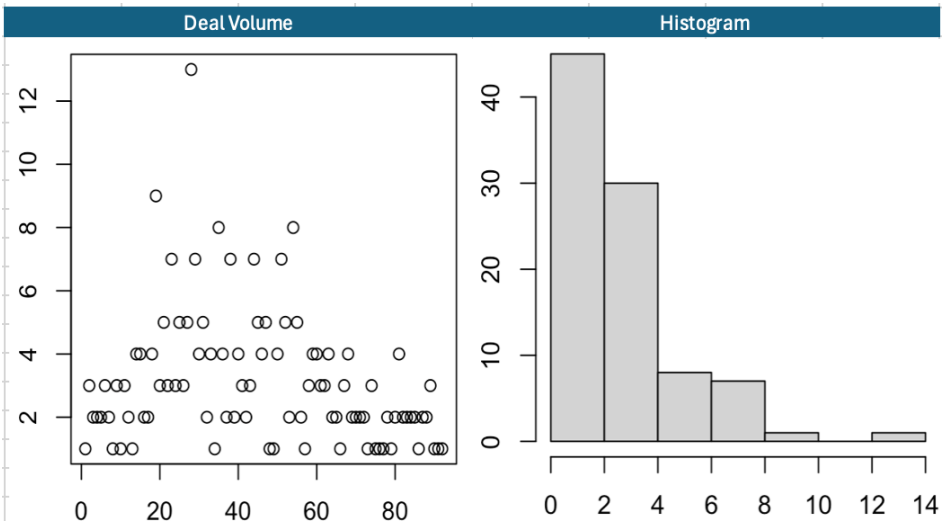
$$H_0 = \textit{The sequence was produced in a random manner}$$
$$H_1 = \textit{The sequence was not produced in a random manner}$$

The random sampling assumption is highly important for regression models. Furthermore, non-random regression models can cause potential biases which effects the regression coefficients and parameter estimate

Appendix 2: Descriptive statistics

This Appendix presents a plot of each variable and a histogram to assess normality. Furthermore, an overview of the descriptive statistics.

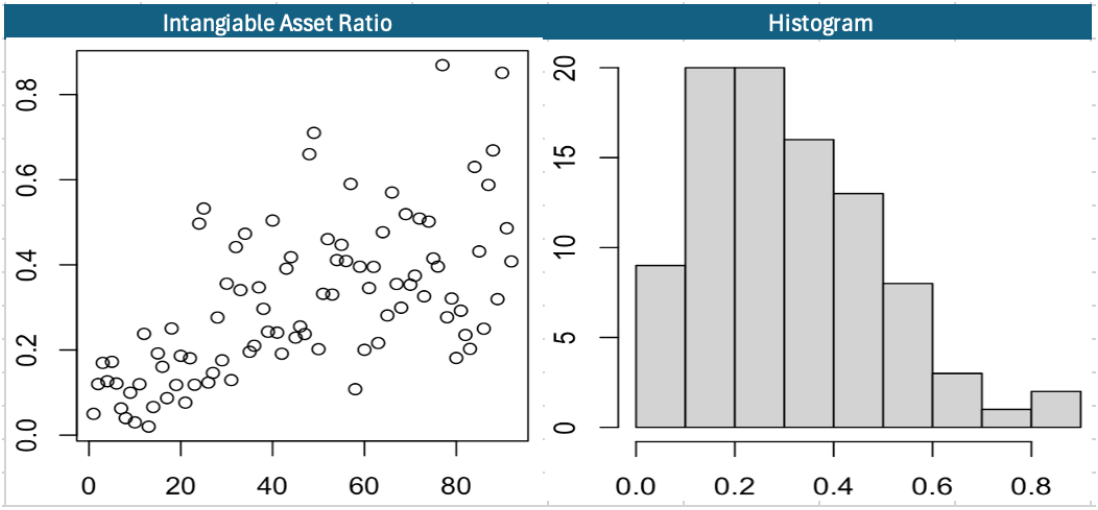
Intangible Asset Ratio (r1)



Conclusion

The data from Deal volume is highly skewed towards the left because of the high concentration of observations from the dot.com wave. Furthermore, it is evident from the histogram that the skewness and kurtosis does not follow a normal distribution.

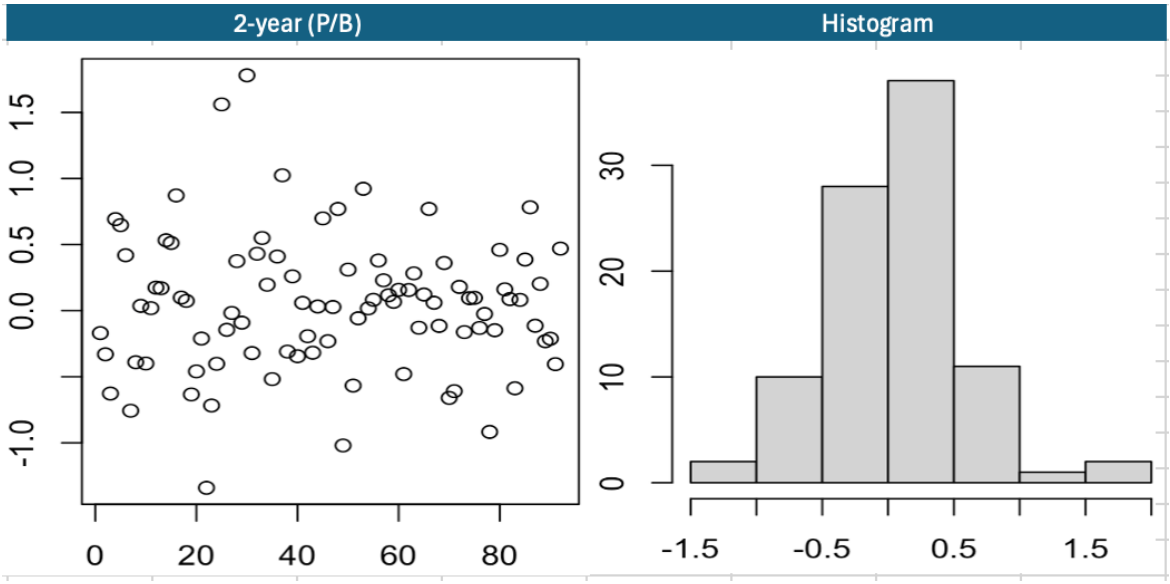
Intangible Asset Ratio (ft1)



Conclusion

As illustrated, the data from intangible asset ratio is left-skewed. Therefore, the data is not normally distributed.

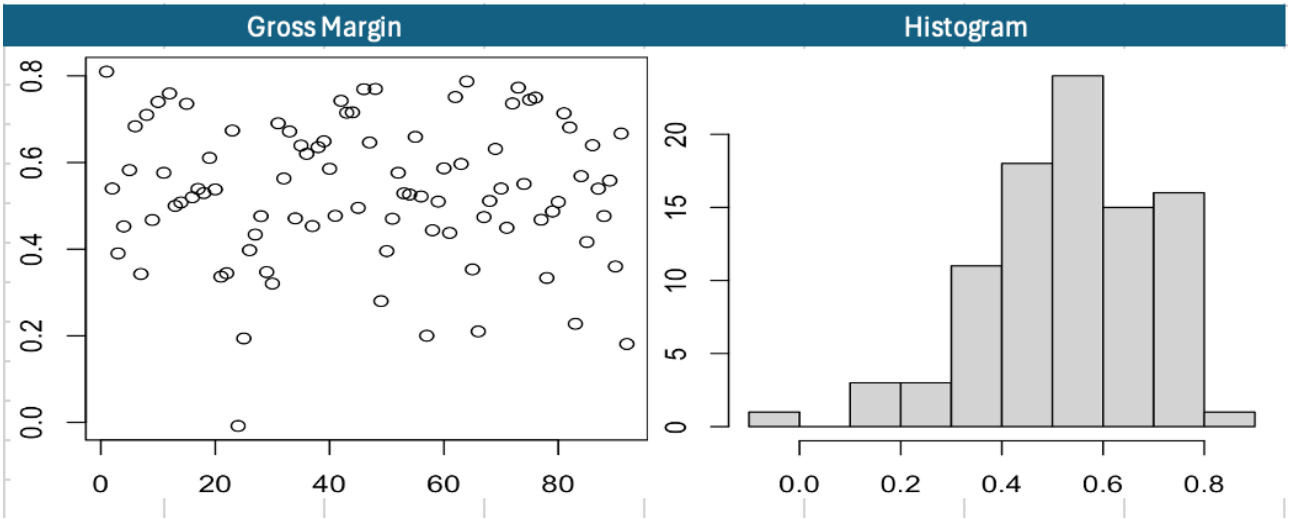
2-year change in Price-to-Book ratio (ft2)



Conclusion

The distribution of the (P/B) variable resembles a normal distribution.

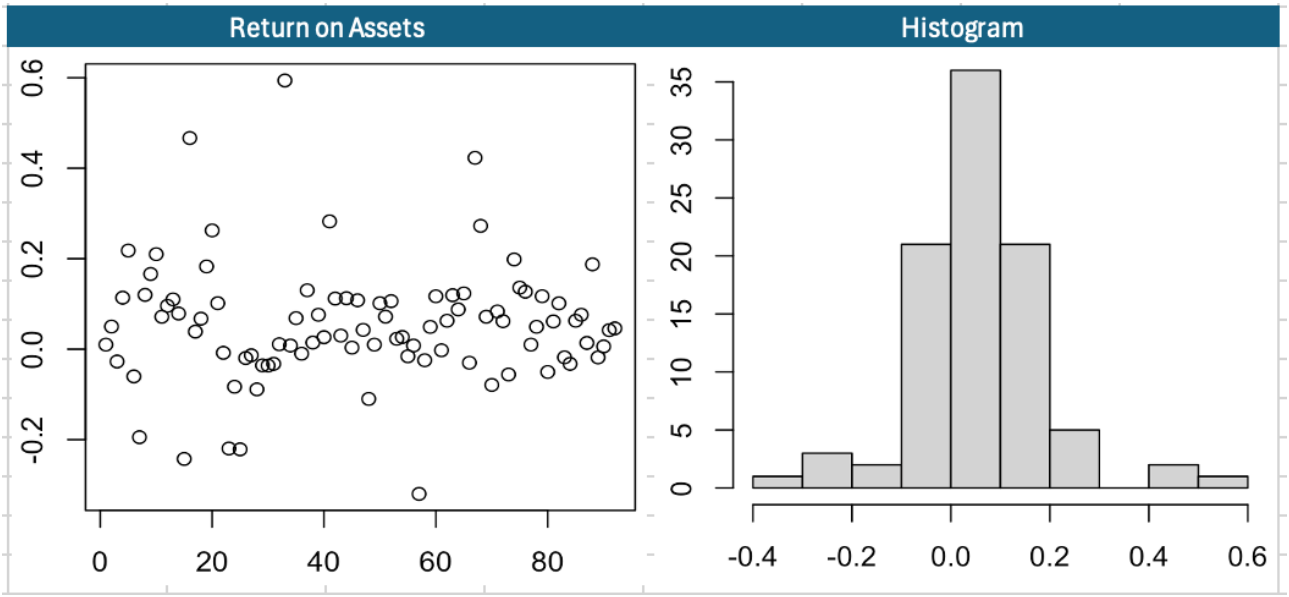
Gross Margin (ft3)



Conclusion

The distribution of gross margin is left-skewed. Indicating non-normality.

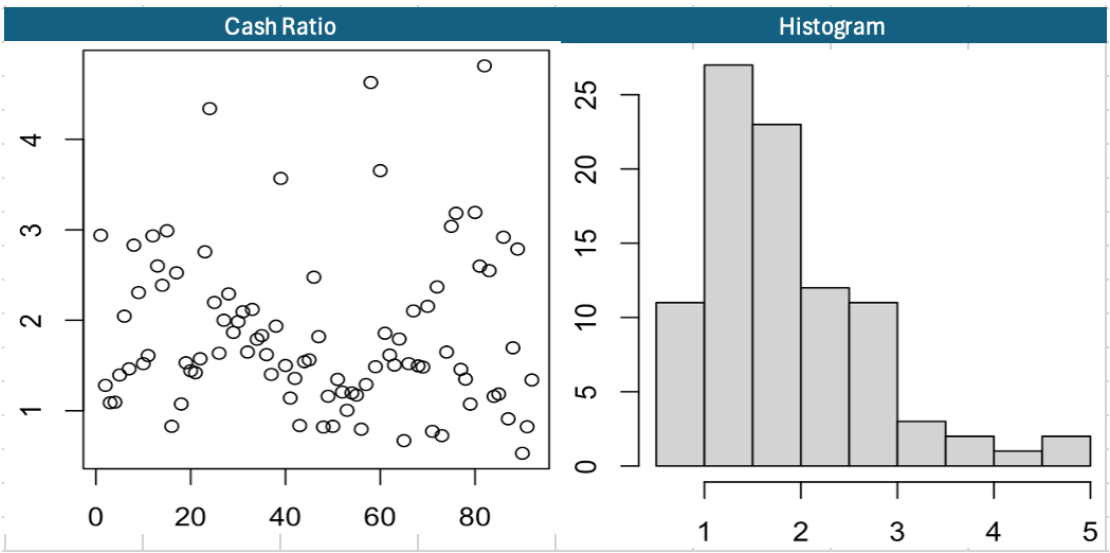
Return on Assets (ft4)



Conclusion

The distribution of ROA resembles a normal distribution. Furthermore, it is evident that outliers are present in the data.

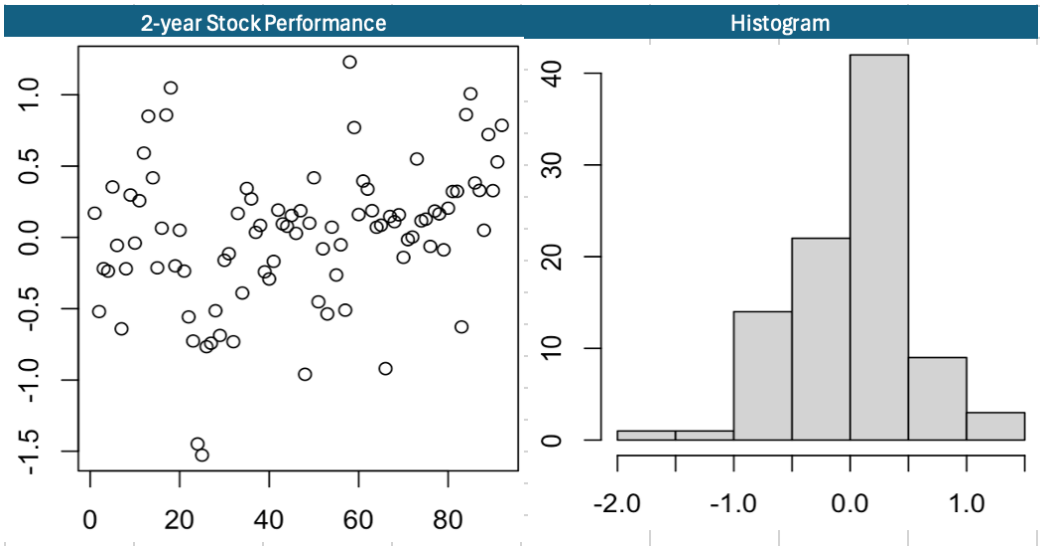
Cash Ratio (ft5)



Conclusion

The distribution of cash ratio is left-skewed. Indicating, that the data is not normally distributed.

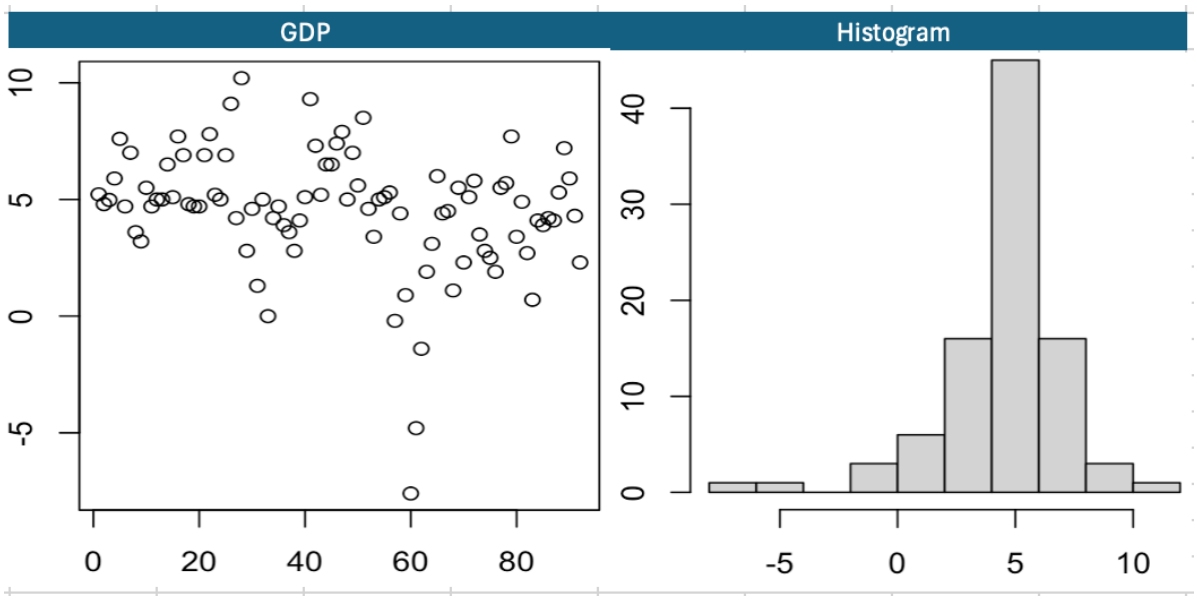
2-year Stock Performance (ft6)



Conclusion

The distribution of stock performance resembles normal distribution with few observations in the tails.

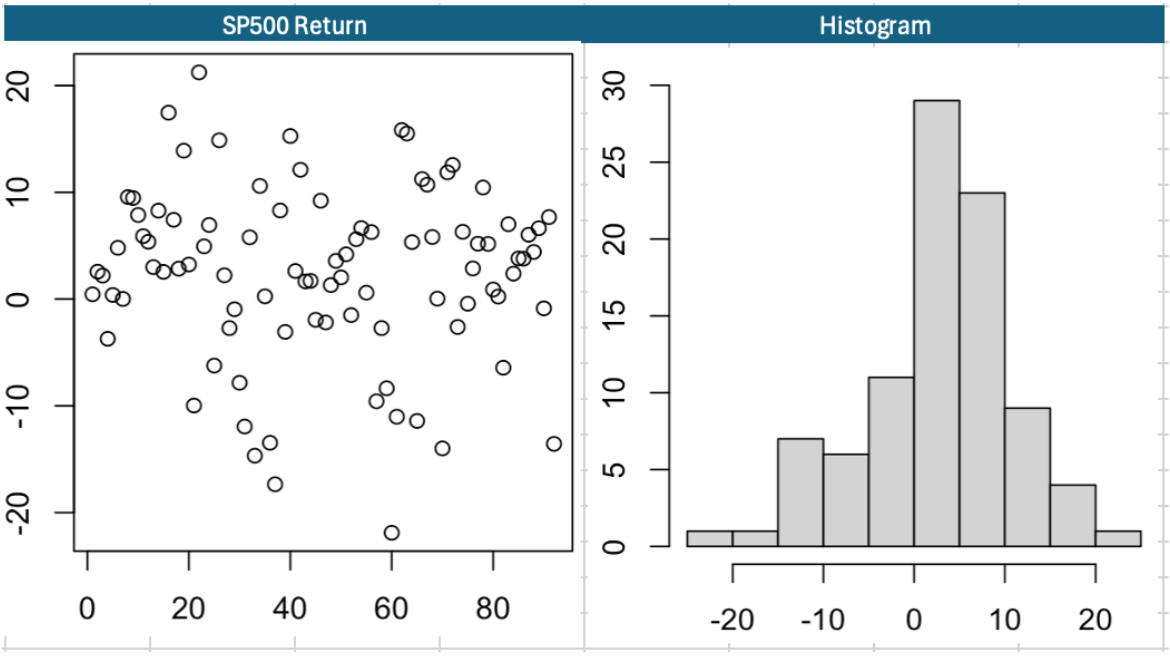
GDP (ft7)



Conclusion

The distribution of GDP is right-skewed. Furthermore, significant negative outlies are present in det sample.

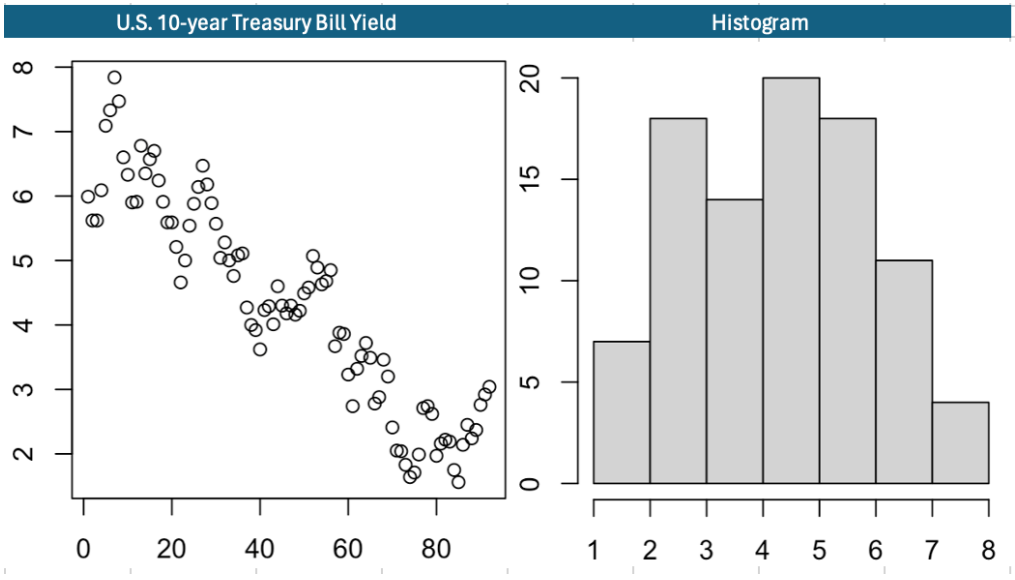
S&P500 Return (ft8)



Conclusion

The distribution of S&P500 is right-skewed. Indicating non-normality.

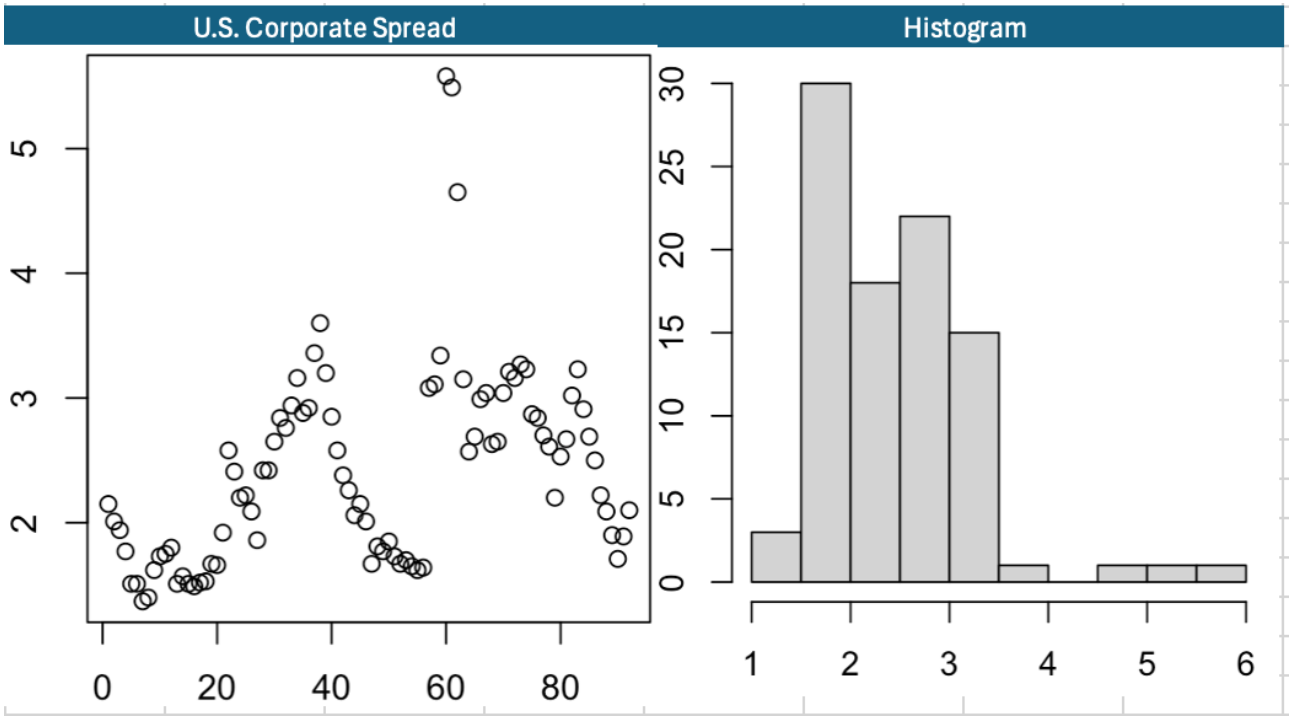
U.S. 10-year Treasury Bill Yield (ft9)



Conclusion

The distribution of treasury bills indicates a slightly skewness to the left. No significant outliers are detected in the data.

U.S. Corporate Spread



Conclusion

The corporate spread distribution is negative left-sided with outliers in the right side of the distribution.

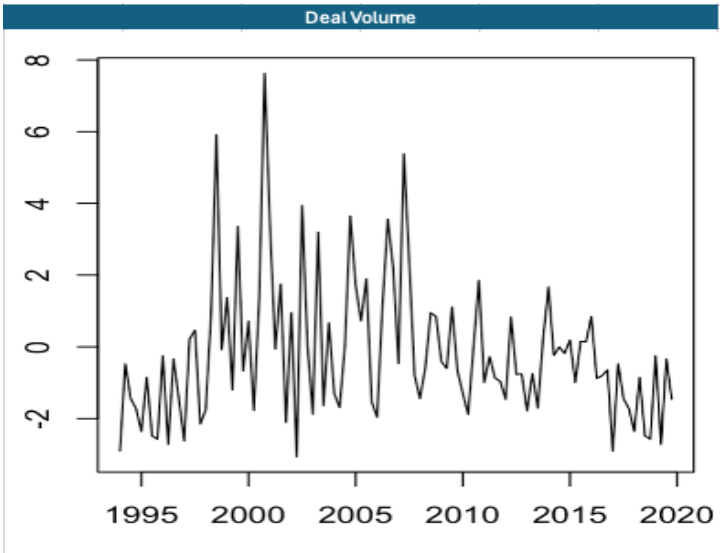
Overview of Descriptive Statistics

Number of Observation 290				
Variable	Mean	Standard Deviation	Minimum	Maximum
Deal Volume	3.1	2.2	1	13
Intantiable Asset Ratio	0.3	0.18	0.02	0.86
2-year (P/B)	0.04	0.5	-1.3	1.7
Gross Margin	0.53	0.16	-0.008	0.81
Return on Assets	0.05	0.13	-0.32	0.59
Cash Ratio	1.8	0.86	0.52	4.8
2-year Stock Performance	0.01	0.49	-1.5	1.2
GDP	4.5	2.6	-7.6	10.2
SP500	2.35	8.1	-21.89	21.24
Treasury Bill Yield	4.3	1.6	1.56	7.84
U.S. Corporate Spread	2.4	0.79	1.37	5.58

Source: Own Creation

Appendix 3: Deal Volume

This section assess stationarity in the dependent variable deal volume.



The plot of the dependent variable indicates non-linearity. The augmented Dickey Fueller test was applied to examine whether deal volume is stationarity.

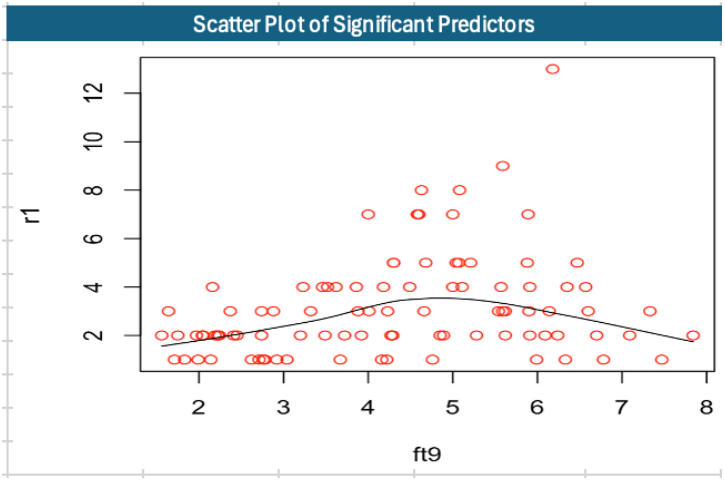
Test	Lag	ADF statistic	P-value
Augmented Dickey Fueller	4	-3	0.15

The test fails to reject the null hypothesis at a 10% significance level. Indicating, deal volume is non-stationary. Hence, deal volume does not have a constant variance and mean. A natural logistic transformation of deal volume could be employed, but a logistic transforming of a count variables is considered inappropriate (Stock & Watson, 2015).

Appendix 4: Model 1

Assumption 1: **Linear Relationship between explanatory variable and the Dependent Variable**

To assess the linearity assumption between the explanatory variable and the response variable a Scatter plot is presented below.



The scatter plot displays a linear relationship between U.S. treasury bill (ft9) and deal volume. Here, the study continues with a certain level of carefulness regarding the linearity assumption. To clarify, whether the independent variable is correlated to the independent variable, the correlation matrix from assumption 4 can provide clarification. Deal volume and treasury bills exhibit a weak positive correlation with a correlation coefficient of 0.27.

Assumption 2: **Assessing if Error Terms Follows a Normal Distribution**

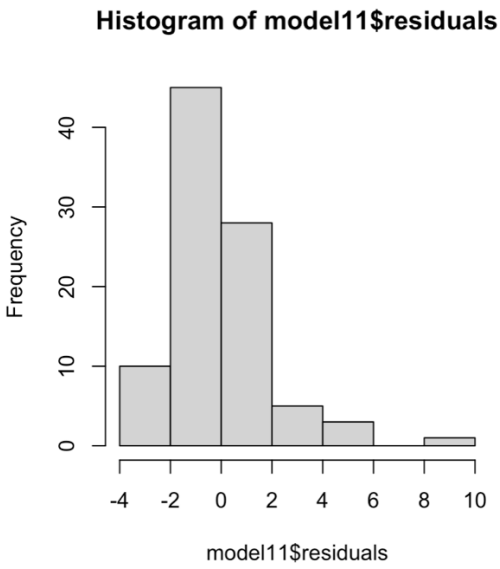
Test	DF	X-squared	P-value
Jarque Bera	2	55.4	0.000***

The test rejects the null hypothesis of normal distribution. Hence, the tests are asymptotical meaning the tests are approximated tests.

Assumption 2: **Testing if Error Terms Follows a Normal Distribution**

Test	W	P-value
Shapiro-Wilk	0.91	0.000***

The null hypothesis is also rejected here. The residuals do not follow a normal distribution. Indicating the hypothesis testing is less reliable.



Visual presentation of the residuals. Clearly, normal distribution of the error terms is rejected. Here, the distribution is heavily left-skewed.

Assumption 3: ***No Serial Autocorrelation***

Test	DF	X-squared	p-value
Box-Ljung test	4	4.7	0.31

The Box-Ljung test fails to reject the null hypothesis, indicating the residuals are white noise.

Assumption 4: ***Testing for Homoscedasticity***

Test	DF	BP	p-value
Breusch-Pegan	1	5.8	0.004***

The Breusch-Pegan test rejects the null hypothesis, indicating heteroskedastic is present. Indicating, the estimator for variance is biased and inconsistent. Therefore, the HAC test was applied to adjust the standard errors and p-values. After the HAC correction, GDP lag 3 becomes insignificant and therefore removed from the model. In the new model containing corporate spread (ft10) and bond yields (ft9), ft10 becomes insignificant and therefore removed from the final model.

Assumption 5: ***Correlation Matrix***

	r1	ft9
r1	1	0.27
ft9	0.27	1

Derived from the correlation matrix, multicollinearity was not regarded an issue in the model.

Assumption 6: ***Testing for Random Sampling of Observations***

Test	n	Test Statistic	P-value
Runs test	92	-1.67	0.093*

The test rejects the null hypothesis, indicating non-randomness at the significance level of 0.1.

Reset test: **Testing Functional Form**

Test	DF	F	P-value
Reset test	1	10.31	0.001***

After performing the HAC test, the p-value clearly rejects the null hypothesis. Indicating, the model is misspecified.

Wald test: **Determining significance of coefficients**

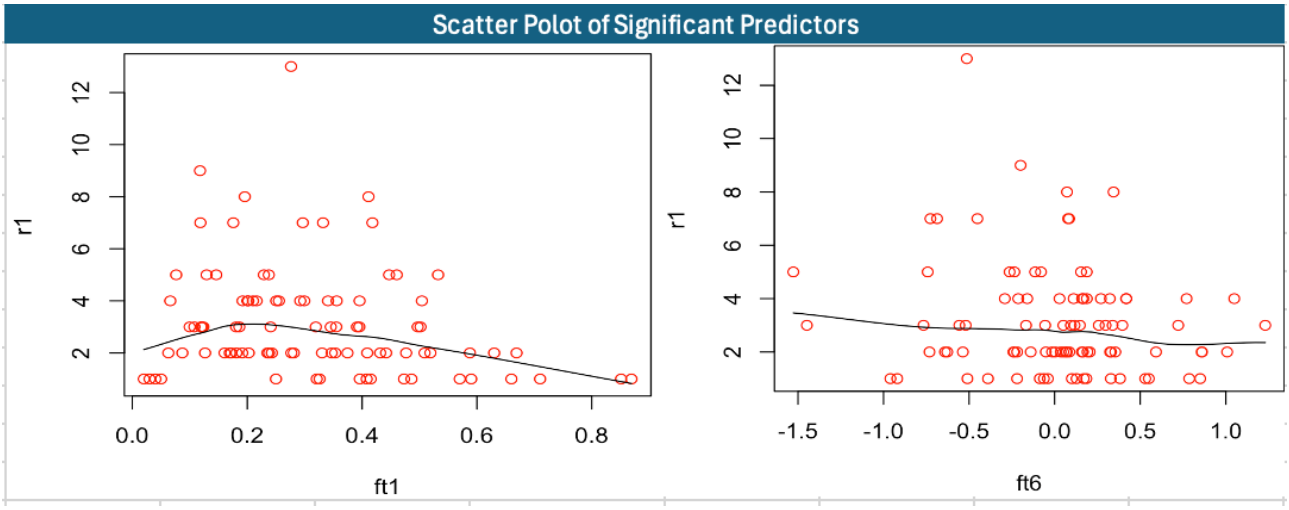
Test	DF	F	P-value
Wald test	-1	3.6	0.0599*

The null hypothesis is rejected based on the 0.1 significance level. Indicating, bond yields have a statistically significant impact on deal volume.

Appendix 5: Model 2

Assumption 1: **Linear Relationship between explanatory variables and the Dependent Variable**

To assess the linearity assumption between the explanatory variables and the response variable a scatter plot of each independent variables and deal volume is presented below.



It is difficult to assess the linearity of the dependent variable and independent variables through a scatter plot. To clarify, whether the independent variables are correlated to the dependent variable the correlation matrix can provide empirical evidence. Intangible Asset Ratio and 2-year stock performance both exhibit a weak negative correlation regarding deal volume.

Assumption 2: **Assessing if Error Terms Follows a Normal Distribution**

Test	DF	X-squared	P-value
Jarque Bera	2	9.374	0.000***

Rejecting the null hypothesis of normal distribution. Hence, the tests are asymptotical meaning the tests are approximated tests.

Assumption 2: **Testing if Error Terms are Normally Distributed**

Test	W	P-value
Shapiro-Wilk	0.87	0.000***

The null hypothesis is rejected. The residuals are not normally distributed. Indicating that hypothesis testing is less reliable.

As visualized by the histogram, the residuals do not follow a normal distribution. The left-skewed distribution indicates negative kurtosis.

Assumption 3: ***No Serial Autocorrelation***

Test	DF	X-squared	p-value
Box-Ljung test	4	8.2	0.08

The Box-Ljung test does not reject the null hypothesis, suggesting residuals are white noise.

Assumption 4: ***Testing for Homoscedasticity***

Test	DF	BP	p-value
Breusch-Pegan	2	3.1	0.2

The Breusch-Pegan test fails to reject the null hypothesis, indicating homoscedasticity is present. Therefore, HAC will not be applied for this regression model.

Assumption 5: ***Correlation Matrix***

	r1	ft1	ft6
r1	1	-0.21	-0.17
ft1	-0.21	1	-0.06
ft6	-0.17	-0.06	1

As presented in the correlation matrix. the correlation between the microeconomic variables and dependent variable were not considered problematic. As they all exhibit a relatively weak negative correlation.

Assumption 6: ***Testing for Random Sampling of Observations***

Test	T-Statistic	P-value
Runs test	-1.2	0.2

The null hypothesis is not rejected, indicating the data is random.

Reset test: **Testing Functional Form**

Test	DF	F	P-value
Reset test	88	0.27	0.6

The p-value is above 0.05 and therefore the test fails to reject null hypothesis. Indicating, the model is correctly specified, and a linear model is appropriate for the data.